BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

JANUARY, 1940.

Isotope shift in the boron spectrum. W. Opechowski and D. A. de Vries (Physica, 1939, **6**, 913—917).—The isotope shift due to the motion of the nucleus has been calc. for the doublet 2497—2498 A. ($3^2S_{\frac{1}{2}}$—$2^2P_{\frac{1}{2},\frac{3}{2}}$) in the spectrum of B, giving a val. of -0.33 cm.$^{-1}$ L. J. J.

Electric glow between carbon electrodes. F. H. Newman (Phil. Mag., 1939, [vii], **28**, 544—547).—The glow produced between electrodes of graphite (99·98%) shows none of the characteristics of a d.c. open arc. The electrodes remain non-incandescent and the glow comes chiefly from the discharge, although there is a band of light surrounding the cathode some distance from the end. In addition a C deposit covers the cathode after the run. The radiation from the glow shows the Swan, CN, and CH bands, but the passage of a discharge from a coil without self-inductance and secondary capacitance leads to the enhancement of the Ångström bands of CO. This indicates that the excitation potential of the latter is > that of the former. T. H. G.

Structure of iridium lines. L. Sibaiya (Physical Rev., 1939, [ii], **56**, 768—769).—The hyperfine structure arising from the nuclear spin moments of $(1/2)(h/2\pi)$ and $(3/2)(h/2\pi)$ of the isotopes 191 and 193, respectively, was investigated for the λλ 3800·10 and 2924·81 Ir lines using an aluminised Fabry–Perot etalon. From the separations obtained the ratio of the nuclear magnetic moments of ^{191}Ir and ^{193}Ir is -0.92. N. M. B.

Isotopes and hyperfine structure. L. Sibaiya (Current Sci., 1939, **8**, 462—465).—A review.

Relative intensities of spectral lines. F. H. Newman (Phil. Mag., 1939, [vii], **28**, 584—587).—The relative intensities of spectral lines due to various components of a mixture depend on their ionisation and resonance potentials, on their partial v.p., on the nature and magnitude of the applied e.m.f. and c.d., and on the proportions of the constituents. With alkali amalgams increase in temp. is accompanied by increase in the intensity of the alkali lines compared with those of the Hg, although in K amalgams the partial pressure of K increases with temp. less rapidly than that of Hg. At const. temp. with an uncondensed discharge the alkali lines are strong compared with those of the Hg, but the former can be suppressed completely by the use of a condensed discharge. T. H. G.

***X*-Ray absorption edges of gaseous, liquid, and solid germanium tetrachloride.** T. Dryński and R. Smoluchowski (Physica, 1939, **6**, 929—940).—The max. and min. in the fine structure of the *K* edge of $GeCl_4$ in solid, liquid, and gas are recorded. Results for gas and liquid are similar. L. J. J.

***L*-Spectrum of tungsten (74). Intense lines.** (Mme.) M. Rouault (Compt. rend., 1939, **209**, 650—651).—Redetermined λλ of 25 lines are recorded, and ν/R and $(\nu/R)^{\frac{1}{2}}$ vals. are given. The γ_4 and γ_4' lines are resolved. A. J. E. W.

M_1 and M_2 *X*-ray absorption edges of lead. J. W. McGrath (Physical Rev., 1939, [ii], **56**, 765—767, 1068).—The edges were found to occur at λλ: M_1 3·219, and M_2 3·469 A. Methods of computing edge energies, and an explanation of the discrepancies between observed and calc. *M* edge vals., are discussed. N. M. B.

Secondary emission of composite surfaces. N. Chlebnikov and A. Korshunova (Tech. Phys. U.S.S.R., 1938, **5**, 363—382).—The secondary emission from surfaces of the type Ag–Cs_2O, Cs–Cs, and Ag–Cs_2O, Cs, and Ag–Cs has been examined. The high val. of the coeff. of secondary emission ρ is due to the presence of free Cs in the Cs_2O layer, and not to metallic particles in general. Ag in the intermediate layer and the concn. and distribution of Cs both affect the voltage for max. emission. $\rho_{max.}$ is independent of the photosensitivity of the surfaces, whilst the presence of Ag reduces the depth of the layer from which secondary electrons are emitted. The mechanism of secondary emission is discussed. F. J. L.

Secondary electron emission. VI. Influence of externally adsorbed ions and atoms on the secondary electron emission of metals. J. H. de Boer and H. Bruining (Physica, 1939, **6**, 941—950; cf. A., 1939, I, 503).—The secondary and photoelectric electron emission from a Mo surface partly covered with Ba atoms have max. vals. at the same degree of covering (σ). At small σ the secondary emission increases approx. linearly, whilst the photoelectric emission increases exponentially with increasing σ. Ba on a W surface shows indications of selective secondary electron emission. L. J. J.

Thermionic and adsorptive properties of the surfaces of a tungsten single crystal. S. T. Martin (Physical Rev., 1939, [ii], **56**, 947—959).—The thermionic emission from a spherical W single crystal shows qual. dependence on crystallographic direction; nearly all the max. and min. lie on a 110 zone. Similar observations were made when Cs and Ba were adsorbed on the crystal. Adsorption forces are largest for Cs on surfaces of highest work function. For Ba the adsorption forces appear to be more dependent on surface structure as the force between the

ion and its image contributes the major part of the adsorption energy. The behaviour of adsorption as a function of crystallographic direction is similar to that of a sphere carved from a perfect lattice; there is no evidence of faceted or step-like microstructure. N. M. B.

Dielectric constant of space containing electrons. S. R. KHASTGIR and K. SIRAJUDDIN (Phil. Mag., 1939, [vii], **28**, 532—543).—Measurements of ϵ have been made for the anode-grid space of a Mullard P.M. 14 valve using ultra-high frequencies and various anode currents i_a. For a given frequency the fall in ϵ was found to be approx. $\propto$ increase in i_a. For const. i_a, ϵ decreases with increase of λ at first, but then increases to a max. >1 and finally falls again. The results are compared with theory. T. H. G.

Properties of electron gas in a magnetic field. A. ACHIESER (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 874—878).—Mathematical. L. J. J.

Secondary production of electrons through the photo-effect in a non-self-dependent hydrogen discharge. H. COSTA (Z. Physik, 1939, **113**, 531—546).—Two sets of electrodes are arranged one above the other, while the lower, and primary, discharge space has a perforated anode. A Townsend discharge is set up in the primary space by irradiation with ultra-violet light and the second set of electrodes allows secondary radiation derived from the primary discharge to be measured. It is established that a photo-electrically active radiation is always present in non-self-dependent H discharges. Increase in current with field strength is > exponential and is explained by secondary electron production. L. G. G.

Ionisation in the positive column. B. N. KLARFELD (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 251—253).—Theoretical. The ionisation in the positive column previously determined under various discharge conditions (cf. A., 1939, I, 503) has been considered from other points of view with substantially the same conclusions. The discrepancies between the experimental and calc. vals. of the no. of ion pairs generated per electron in the plasma per sec. are much reduced in the present method. C. R. H.

Diffusion of ions in a discharge and initial rate of gas deionisation. I, II. B. L. GRANOVSKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 883—887, 888—890).—I. Mathematical.

II. Formulæ developed in (I) are used to calculate the diffusion coeff. of ions in Hg vapour for a cylindrical plasma. L. J. J.

Mobility of potassium ions at high field intensity and low pressure. A. V. HERSHEY (Physical Rev., 1939, [ii], **56**, 908—915).—The mobility of K ions in H_2, He, N_2, and A was investigated by the Townsend method, in which a beam of ions is deflected by a magnetic field, and the variation of the mobility as a function of the ratio E/p (E = electric intensity) is examined. The mobility is const. only in weak fields; it rises with increase in E/p, passes through a peak, and then falls. A generalised Langevin mobility theory gives qual. agreement with results, but fails to account for more than a suggestion of the peaks which are, however, accounted for by a generalisation of the Hassé–Cook theory. N. M. B.

Mobility of ions of high velocity. A. V. HERSHEY (Physical Rev., 1939, [ii], **56**, 916—922; cf. preceding abstract).—Mathematical. The Langevin and Hassé–Cook theories of ionic mobility in weak fields are generalised to fields of any strength. N. M. B.

Magnetic moments of the proton and the deuteron. Radio-frequency spectrum of H_2 in various magnetic fields. J. M. B. KELLOGG, I. I. RABI, N. F. RAMSEY, jun., and J. R. ZACHARIAS (Physical Rev., 1939, [ii], **56**, 728—743; cf. A., 1939, I, 297).—Using the mol. beam magnetic resonance method, the nuclear moment is obtained by observing the Larmor frequency of precession in a uniform magnetic field. Sharp resonance min. for HD and D_2 mols. lead to an accurate val. of μ_P/μ_D. The radio-frequency spectrum of ortho-H_2 contains 6 resonance min. from which μ_P is derived. Vals. obtained are: $\mu_P = 2{\cdot}785 \pm 0{\cdot}02$; $\mu_D = 0{\cdot}855 \pm 0{\cdot}006$ nuclear magneton; $\mu_P/\mu_D = 3{\cdot}257 \pm 0{\cdot}001$; $\mu_P/r^3 = 34{\cdot}1 \pm 0{\cdot}3$ gauss, giving $\mu_P = 2{\cdot}785 \pm 0{\cdot}03$. Results agree with those from at. beam measurements of the hyperfine structure of the ground states of H and D (cf. A., 1936, 1316). N. M. B.

Effect of a weak magnetic field on plasma. C. M. FATALIEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 891—895).—The effect of magnetic fields up to 60 gauss on the characteristics of plane probes in A and Ne discharge tubes at pressures <1 mm. Hg have been studied. L. J. J.

Hall effect in plasma. M. I. RODIN and G. V. SPIVAK (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 247—249).—The change in electron concn. along the radius of a cylindrical discharge tube has been studied for A, Ne, and Hg vapour, and the cross p.d. of the Hall effect has been determined. A crossed magnetic field deviates the entire discharge towards the wall of the tube according to Ampère's law, although a weak field has only a slight effect on the heavy Hg ions. The Hall effect decreases with increasing current. C. R. H.

At. wt. of hydrogen. F. BRESCIA and R. ROSENTHAL (J. Chem. Educ., 1939, **16**, 494—495).—A review of recent work. L. S. T.

Mass and energy levels of ^{33}S. E. POLLARD (Physical Rev., 1939, [ii], **56**, 961).—The absorption curve of protons liberated from a S target bombarded with 3·1-Me.v. deuterons from a cyclotron showed well-marked groups with energy changes +6·60, +3·70, and +1·02 Me.v. Assuming the reaction $^{32}S + {}^{2}H \rightarrow {}^{33}S + {}^{1}H$, the mass val. found for ^{33}S is $32{\cdot}9818 \pm 0{\cdot}0030$ (cf. Barkas, A., 1939, I, 297). The second and third groups indicate, respectively, an excited state 2·9 Me.v. above the ground state, and a second excited state 5·58 Me.v. above the ground state (or C contamination). N. M. B.

Application of the coincidence method to testing the lifetime and level scheme of radium-C'. J. ROTBLAT (Nature, 1939, **144**, 248—249).—The application of the coincidence method to investigations of nuclear processes has been extended by using a variable resolving time of the coincidence circuit and

by measuring counts arising from two impulses separated only by a short time interval. Application of the method to the transformation Ra-$C \rightarrow$ Ra-$C' \rightarrow$ Ra-D gives a curve from which the half-life period of Ra-C' is found to be $(1{\cdot}40 \pm 0{\cdot}15) \times 10^{-4}$ sec. No γ-radiation follows the emission of the α-particle in the transition Ra-$C' \rightarrow$ Ra-D. The measurements confirm, in general, the level scheme of Ra-C' put forward by Ellis and Oppenheimer. L. S. T.

Element 87. Ac-*K*, derived from actinium. (MLLE.) M. PEREY (J. Phys. Radium, 1939, [vii], **10**, 435—438).—A detailed account of work already noted (A., 1939, I, 170). W. R. A.

Radiation from the radio-element Ac-*K*. (MLLE.) M. PEREY and M. LECOIN (J. Phys. Radium, 1939, [vii], **10**, 439—440).—A detailed account of work already noted (A., 1939, I, 591). W. R. A.

Production of positive electrons by β-particles. G. J. SIZOO and F. BARENDREGT (Physica, 1939, **6**, 1085—1100).—The intensity and energy distribution of positrons emitted by Ra-$B + C$ have been studied with a cloud chamber. The ratio of positrons to electrons emitted is 0·011, ~90 times that calc. by means of Jaeger and Hulme's theory. Most positrons have energies $<0{\cdot}3$ Me.v. Only a small fraction of positrons excited in Pb can be ascribed to external pair formation by γ rays; the effective cross-section for pair formation by β-rays is $\sim 10^{-22}$ sq. cm. L. J. J.

Range groups of the natural H-radiation. T. SEXL and P. URBAN (Z. Physik, 1939, **113**, 554—561).—A general discussion of α-particle scattering in H in the light of the Guth–Sexl theory. L. G. G.

Diffuse radiation of neutrons by the cyclotron. D. G. ALCHASOV, I. K. KURTSCHATOV, M. G. MESCHTSCHERJAKOV, and V. I. RUKAVISCHNIKOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 32—33).—The conditions for obtaining max. radiation of neutrons are discussed. D. F. R.

Production of a beam of fast neutrons. P. C. AEBERSOLD (Physical Rev., 1939, [ii], **56**, 714—727).—Well-defined intense beams of fast neutrons were produced by using shields of paraffin and Pb in conjunction with a Be plate bombarded by deuterons accelerated to 8 Me.v. in a cyclotron. Ionisation measurements and photographs show that the fast neutron effects are mainly localised to a beam collimated by a 50-cm. paraffin or H_2O tunnel lined with Pb to suppress, with the addition of a Pb filter, γ-radiation. The working and performance of the apparatus are described. N. M. B.

Neutron sources of long time action. A. POLESITZKI and A. RATNER (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 250).—The detailed prep. of Ra + Be and RaTh + Be sources is described, and advantages are claimed over the usual neutron sources. C. R. H.

Scattering of neutrons from the C + D reaction. E. AMALDI, D. BOCCIARELLI, F. RASETTI, and G. C. TRABACCHI (Physical Rev., 1939, [ii], **56**, 881—884).—Scattering cross-section data for neutrons emitted by bombarding C with 600-ke.v. deuterons are tabulated for 39 elements. N. M. B.

Scattering of photoneutrons from deuterium by the nuclei of atoms of light elements. T. GOLOBORODKO and A. LEIPUNSKI (Physical Rev., 1939, [ii], **56**, 891—892).—Photoneutrons (energy ~210 ke.v.) from D (D_2O) irradiated by γ-rays from RaTh were scattered by the nuclei of 17 elements (H—Ca). Cross-section data are tabulated and show fluctuations similar to those for Ra–Be photoneutrons. Mg and Si show a sharp anomaly. N M. B.

Neutron scattering in normal and para-hydrogen. A. LEIPUNSKI and D. JIMOSCHUK (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 579—581).—The scattering cross-sections of gaseous para- and ortho-H for neutrons of energies 0·037 and 0·019 e.v. were found to be $22—47 \times 10^{-24}$ sq. cm. and $55 - 71 \times 10^{-24}$ sq. cm., respectively. F. J. L.

Artificial radioactive indicators. C. ROSENBLUM and J. F. FLAGG (J. Franklin Inst., 1939, **228**, 471—494, 623—648).—A review of the uses of radioactive indicators, including solubility measurements, rates of diffusion in alloys, and the distribution of certain elements in living matter. A. E. M.

Possibility of the formation of α-radioactive nuclei in the decay of radiochlorine. N. N. DMITRIEV, K. A. PETRSHAK, and N. A. PERFILOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 622—624).—Using both slow and fast neutrons with NaCl or Cl_2, ^{38}Cl formed does not show α-radioactivity as reported by Libby *et al.* (A., 1936, 1441). A formed by the decay of ^{38}Cl is stable. W. R. A.

Energy of conversion electrons arising in the transformation of bromine isomerides. L. I. RUSINOV and A. A. JUSEFOVITSCH (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 129—130).—The transformation of isomeric Br nuclei has been investigated by determining the energy of the conversion electrons with a magnetic spectrograph. Vals. obtained are in good agreement with those of Valley and McCreary (A., 1939, I, 294). W. R. A.

***X*-Ray emission from the isomerides of radioactive bromine.** L. I. RUSINOV and A. A. JUSEFOVITSCH (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 576—578).—Radioactive Br emits an *X*-radiation, with a 4-hr. period, which is completely absorbed by 1 mm. of Pb. Absorption measurements using Al, As, Se, Hg, and Pb as absorbers indicate that $\lambda = \sim 1$ A. ($K\alpha$ of Br) and that the radiation is due to the metastable Br nucleus passing to the ground state by inner conversion, followed by β-disintegration. F. J. L.

Identification of characteristic *X*-rays associated with radioactive decay. P. H. ABELSON (Physical Rev., 1939, [ii], **56**, 753—757).—A bent rock-salt crystal spectrograph (cf. A., 1938, I, 300) was found suitable for the identifications, and results on *X*-rays associated with the disintegration of $^{67}_{31}Ga$, $^{64}_{29}Cu$, $^{80}_{35}Br$, and $_{43}Ma$ are reported. N. M. B.

Search for β- and delayed γ-radiation from the deuteron–deuteron reaction. M. H. KANNER and W. T. HARRIS (Physical Rev., 1939, [ii], **56**, 839—840; cf. Bonner, A., 1939, I, 397).—Experiments to detect the following possible decay processes of an excited state of ^3He having 1·84 Me.v. excitation energy are

described: $^{3*}He \rightarrow {}^{3}He + \gamma$; $^{3*}He \rightarrow {}^{3}He + \gamma$ (largely internally converted); $^{3*}He \rightarrow {}^{3}H + e^{+}$ (upper limit of spectrum 0·8 Me.v.). Results show no evidence of internal conversion or short-lived positron radioactivity, and that if there exists an excited ^{3}He its lifetime for positron emission is >10 days and its lifetime for γ-ray emission is >45 min. N. M. B.

Magnetic spectrograph investigation of ^{13}N γ-radiation. G. E. VALLEY (Physical Rev., 1939, [ii], **56**, 838—839; cf. Richardson, A., 1939, I, 295).—Available data indicate that the decay of ^{13}N is accompanied by a 280±30-ke.v. γ-ray occurring in 20—40% of all ^{13}N disintegrations. In view of this variation, the ^{13}N γ-ray spectrum was explored by measuring the energy and intensity of the secondary electrons ejected from Pb and Al foils of equiv. thickness. There is no evidence for a photo-electron line at ~280±30 ke.v.; there is $\not>$0·05 γ-ray per disintegration and at no point in the range 200—325 ke.v. can there be $>$0·11 γ-ray per disintegration. N. M. B.

Coincidences between β- and γ-rays in ^{24}Na. L. M. LANGER, A. C. G. MITCHELL, and P. W. MCDANIEL (Physical Rev., 1939, [ii], **56**, 962—963; cf. Lawson, A., 1939, I, 505, Richardson, A., 1938, I, 113).—In view of conflicting data on the energies and complexity of the spectra, NaF was bombarded with neutrons from a Ra–Be source, and coincidences were measured using this and also a strongly activated ^{24}Na source from a cyclotron. The end-point of the β-ray spectrum was 1·43±0·05 Me.v. The no. of β–γ coincidences per 1000 β-rays is const. at 3·0 throughout the spectrum, indicating that the β-ray spectrum consists of a single group; ^{24}Mg is formed in an excited state. The no. of γ–γ coincidences per 1000 γ-ray counts is 1·72±0·05, giving an average of 2·36 γ-rays per disintegration. Transition stages are discussed. N. M. B.

β-Ray spectra of ^{27}Mg, ^{62}Cu, and the nuclear isomerides of ^{104}Rh. E. C. CRITTENDEN, jun. (Physical Rev., 1939, [ii], 56, 709—713).—Cloud-chamber investigation in a uniform magnetic field gives ^{27}Mg and ^{62}Cu β-ray spectra with upper limits of 1·8 and 2·6 Me.v., respectively. The spectra of the two nuclear isomerides of ^{104}Rh have the same upper limit of 2·3 Me.v., and, within experimental error, the same shape (cf. A., 1939, I, 54), indicating that a direct β-transition from the 4·37-min. level does not occur appreciably, and that the disintegration of the 4·37-min. isomeride proceeds entirely by a γ-ray transition to the ground state of ^{104}Rh followed by a β-transition to the ground state of ^{104}Pd. N. M. B.

Internally converted γ-rays of several radioactive elements. G. E. VALLEY and R. L. MCCREARY (Physical Rev., 1939, [ii], **56**, 863—871).—An investigation of conversion electron spectra of radioactive elements produced by proton and deuteron bombardment in the cyclotron gave the following results: ^{80}Br (4·4 hr.) three conversion lines observed corresponding with two γ-rays, 48·9±0·4 and 37·1 or 25·3 ke.v., both arising in the isomeric transition to the 18 min. state. ^{78}Br (6·3 min., e^{+}) K and L_1 conversions in Se of two γ-rays, 45·8±0·4 and 107·7±0·9 ke.v. ^{107}Cd or ^{109}Cd (6·4 hr., K capture) K, L_1, and M_1 conversions of a γ-ray of 92·6±0·8 ke.v. ^{67}Ga (78 hr., K capture) K and L_1, conversions of a γ-ray of 92·5±0·8 ke.v. ^{70}Ga (18·5 min., e^{-} and possibly K capture) K and L_1 conversions of a γ-ray of 53·8±0·5 and probably a second line of ~117 ke.v. N. M. B.

Secondary γ-radiation (retardation radiation) excited by β-particles of $^{32}_{15}P$. G. J. SIZOO, C. EIJKMAN, and P. GROEN (Physica, 1939, 6, 1057—1076).—After complete absorption of the β-particles from $^{32}_{15}P$ in Al, penetrating γ-radiations remain, comparable in intensity with those from Ra. The γ-rays consist of internal and external retardation radiations with energies 6 and 1 ke.v. per disintegration electron, respectively. The intensity of the external retardation radiation produced by absorption of the β-rays in C, Al, Fe, Cu, Sn, and Pb is roughly $\propto$ (at. no.)^2/at. wt. of the absorbing atom. L. J. J.

Pair emission from fluorine bombarded with protons. W. A. FOWLER and C. C. LAURITSEN (Physical Rev., 1939, [ii], 56, 840—841; cf. A., 1939, I, 294).—In order to investigate the possible existence of radiation of low penetrating power from the reaction $^{19}F + {}^{1}H \rightarrow ({}^{20}Ne) \rightarrow {}^{16*}O + {}^{4}He$, measurements by simultaneous observations with two ionisation chambers, one having 3·3 mm. Pb as filter, are described. A radiation absorbed in 3 mm. Pb and consisting not of soft γ-radiation but probably of fast electrons was found. Cloud-chamber identification of pairs indicates that ionisation with energy 5·9±0·5 Me.v. is produced by pairs. Evidence is given that the pairs are not produced by internal conversion of γ-rays, but are emitted directly from a nucleus in an excited state ($^{16*}O$, or a transition in ^{20}Ne). N. M. B.

Low-energy γ-radiation from lithium bombarded with protons. W. A. FOWLER and C. C. LAURITSEN (Physical Rev., 1939, [ii], 56, 841).—The method given in the preceding abstract was used to investigate the radiation from $^{7}Li + {}^{1}H$ as a function of proton energy. A resonance at 440 ke.v. appears to be due entirely to 17·5-Me.v. γ-radiation. The val. 495±25 ke.v. is found for the γ-rays at 1080 and 1290 ke.v. bombarding energy, and results indicate that this radiation originates from excitation of ^{7}Li without capture of the proton (cf. A., 1939, I, 4). N. M. B.

Radioactivities produced by proton bombardment of palladium. T. ENNS (Physical Rev., 1939, [ii], 56, 872—876; cf. Pool, A., 1938, I, 113).—Proton bombardment of Pd produces the known periods 2·3 min. (^{108}Ag), 25 min. and 8 days (^{106}Ag), and new periods of 16·3 min. (+), 73 min. (+), and 45 days (K capture), assigned provisionally to ^{102}Ag, ^{104}Ag, and ^{105}Ag, respectively. Excitation functions for the isomeric 25-min. and 8-day periods give p–n thresholds of 3·8 and 3·9 Me.v., respectively. The 8-day activity is accompanied by probably three γ-rays of which two of 0·62 and 1·06 Me.v. have been identified with a β-ray spectrograph. Since no positrons accompany this activity it must decay mainly by K-electron capture to ^{106}Pd rather than to the lower isomeric state. Four γ-rays of ~0·29, 0·42, 0·50, and 0·69 Me.v. accompany the 45-day period. N. M. B.

Disintegration of beryllium by electrons. G. B. Collins, B. Waldman, and E. Guth (Physical Rev., 1939, [ii], **56**, 876—880; cf. A., 1939, I, 232).—The Be nucleus was disintegrated by fast electrons from a 1·8-Me.v. Van de Graaff generator. The reaction is $^9Be + e \rightarrow {}^8Be + n + e'$, where e' denotes energy of electrons after the disintegration. The radioactivity induced in Ag by the neutrons formed was used as a measure of the rate of disintegration. The yield curve fixed the threshold for the disintegration of Be at $1{\cdot}63 \pm 0{\cdot}05$ Me.v. At 1·73 Me.v. the cross-section is 10^{-31} sq. cm., in good agreement with theory. The yield curve for photodisintegration by continuous X-rays gave a threshold identical with that for disintegration by electrons. N. M. B.

Disintegration of uranium by neutrons. N. Perfilov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 896—898).—Cloud-chamber photographs show tracks of recoil nuclei with a max. range $\sim$3 cm. when U_3O_8 is irradiated with neutrons from a Ra + Be source. The ionising power of the recoil particles is $\gg$ that of α-particles and indicates a large and variable change. L. J. J.

Division of uranium nuclei by neutrons and the existence of trans-uranium elements. V. G. Chlopin, M. A. Pasvik-Chlopina, and N. F. Volkov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 118—121).—The rates of decay of PtS from U after neutron bombardment, and from the recoil atoms, differ from those given by Meitner and Frisch (A., 1939, I, 233) and by Bretscher and Cook (*ibid.*, 296). A tentative explanation of the discrepancies is given. W. R. A.

Evidence for a chain nuclear reaction in the middle of a uraniferous mass. H. Halban, jun., F. Joliot, L. Kowarski, and F. Perrin (J. Phys. Radium, 1939, [vii], **10**, 428—429).—A hollow Cu sphere, 50 cm. diameter, containing at its centre a source of photo-neutrons (Ra + Be), was immersed in H_2O, and the density of the neutrons was measured by the activity I induced in Dy detectors placed either inside the sphere or in the surrounding H_2O, when the sphere was filled with (i) H_2O, (ii) dry U_3O_8, (iii) H_2O and U_3O_8 (H/U = 1, 2, and 3). From a consideration of the different curves $Ir^2 = f(r)$, where r = distance from the source to the detector, it is concluded that some of the neutrons produced are of secondary and tertiary origin, indicating that convergent chain reactions occur. W. R. A.

Time variations of cosmic rays. A. H. Compton (J. Franklin Inst., 1939, **227**, 607—621).—A general survey of the periodic and non-periodic variations of cosmic rays, and speculations regarding their source. F. J. L.

Fundamental principles underlying the theory of cosmic radiation. A. Baños, jun. (J. Franklin Inst., 1939, **227**, 623—645). F. J. L.

Equality of the proton–proton and proton–neutron interactions. F. W. Brown and M. S. Plesset (Physical Rev., 1939, [ii] **56**, 841—842; cf. A., 1939, I, 395).—Interaction consts. are calc. and discussed. N. M. B.

Effects of shape of potential energy wells detectable by experiments on proton–proton scattering. L. E. Hoisington, S. S. Share, and G. Breit (Physical Rev., 1939, [ii], **56**, 884—890).—The shapes of several types of potential wells giving approx. agreement with proton–proton scattering experiments are discussed. N. M. B.

Proton–proton scattering data. E. Creutz (Physical Rev., 1939, [ii], **56**, 893—894; cf. Breit, A., 1939, I, 395).—A more detailed analysis of data, computation of coeffs., and comparison with theory. N. M. B.

Deviation from the Coulomb law for a proton. H. Fröhlich, W. Heitler, and B. Kahn (Physical Rev., 1939, [ii], **56**, 961—962).—Mathematical. A reply to Lamb (A., 1939, I, 547). N. M. B.

Scattering of neutrons by protons. C. Kittel and G. Breit (Physical Rev., 1939, [ii], **56**, 744—749).—Mathematical. Theoretical results are compared with available experimental data. Effects $\sim$50% in the angular distribution may be expected for 16-Me.v. neutrons. N. M. B.

Dispersion formula for nuclear reactions. A. J. F. Siegert (Physical Rev., 1939, [ii], **56**, 750—752).—Mathematical. An improved form of derivation based on the method of Kapur and Peierls (cf. A., 1938, I, 430). N. M. B.

Spinor equations for the meson and their solution when no field is present. A. H. Taub (Physical Rev., 1939, [ii], **56**, 799—810).—Mathematical. The spinor equations equiv. to the Proca equations for the meson are found, and their differences from those proposed by Dirac are examined and interpreted. N. M. B.

Secondary action of mesotron radiation. B. Trumpy (Z. Physik, 1939, **113**, 582—586).—Cloud-chamber measurements on secondary action of mesotrons are discussed on a basis of the theories of Bhabha and Heitler. L. G. G.

Disintegration of mesotrons. B. Rossi, H. van N. Hilberry, and J. B. Hoag (Physical Rev., 1939, [ii], **56**, 837—838).—An additional air layer of 82 g. per sq. cm. between two altitudes reduced the mesotron intensity by > twice as much as did a graphite screen of 84 g. per sq. cm., a reduction which cannot be ascribed to the difference in stopping power of air and C, but indicates the disintegration of mesotrons. Results show that 1·3 mesotrons out of 11 disintegrate in travelling $1{\cdot}06 \times 10^5$ cm., giving $8{\cdot}5 \times 10^5$ cm. for the disintegration mean free path. N. M. B.

Life-time of the mesotron. I. M. Freeman (Nature, 1939, **144**, 667; cf. A., 1939, I, 447).—The theory that a heavy electron is a quasi-stable state of an ordinary electron (A., 1938, I, 291) gives for the life-time of a mesotron a formula which yields a result in agreement with the experimental val. of $\sim 2{\cdot}5 \times 10^{-6}$ sec. L. S. T.

Invariant perturbation theory of the electron-neutrino particle under the influence of electromagnetic and nuclear fields (field theory of matter). II. E. C. G. Stueckelberg (Helv. Phys.

Acta, 1936, **9**, 533—554; Chem. Zentr., 1937, i, 3105; cf. A., 1938, I, 491).—Recombination of a K electron with an at. nucleus (*i.e.*, a reversed β-disintegration) gives rise to a discrete neutrino spectrum and a continuous γ-ray spectrum. An atom so produced has a calc. life period ($z = 14$) ~1000 times that of β-active atoms. A. J. E. W.

Shape of β-ray spectra and mass of the neutrino. L. A. SLIV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 34—37).—The Konopinski–Uhlenbeck formula is modified by taking the mass of the neutrino as approx. equal to that of the electron. Closer agreement is then obtained between theory and experiment. D. F. R.

Ionisation of the atom due to β-decay. E. L. FEINBERG (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 779—782).—Mathematical. A. J. M.

Formulæ and theoretical curves for γ-rays. T. KAHAN (J. Phys. Radium, 1939, [vii], **10**, 430—434).—Theoretical. The limits of the validity and application of the different theoretical expressions for the three effects, photo-electric absorption, Compton diffusion, and materialisation processes, have been considered. Various curves are given from which the no. of electrons projected by the Compton effect can be determined; they present the three effects as functions of the at. no. and of the energy of the incident quantum. W. R. A.

Cosmological constancy of the fine structure constants. P. JORDAN (Z. Physik, 1939, **113**, 660—662).—A consideration of possible variation in space-time of the const. e^2/hc. L. G. G.

Quadrupole moment of the deuteron and nuclear forces. S. FLÜGGE (Z. Physik, 1939, **113**, 587—595).—Mathematical. L. G. G.

Numerical calculation of activation energy for the Weizsäcker nuclear elongation. K. UMEDA (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 735—736).—The energy peak between the two stable forms of a highly-charged at. nucleus has been evaluated graphically. The activation energy is much smaller than the excitation energy of neutron capture, and of the same order of magnitude as the surface energy liberated on neutron capture, according to Eötvös' law. L. J. J.

Theory of the Senftleben effect. F. ZERNIKE and C. VAN LIER (Physica, 1939, **6**, 961—971).—The effect of magnetic precession on mean free path (cf. Gorter, A., 1938, I, 233) is calc. L. J. J.

$^1\Sigma \rightarrow {}^1\Sigma$ Transition of the C_2 molecule. O. G. LANDSVERK (Physical Rev., 1939, [ii], **56**, 769—777).—Using photographs taken on the 30-ft., 30,000-line grating spectrograph, accurate measurement and analysis of the λ 2300 band of the C arc show that the structure consists of superposed (0, 0), (1, 1), (2, 2), and (3, 3) headless bands of a $\Sigma \rightarrow \Sigma$ transition of C_2 (or C_2^+). Alternate lines are missing in each series, as expected in view of the zero spin of the C nucleus. Most probably the transition is $^1\Sigma_u^+ \rightarrow {}^1\Sigma_g^+$ of C_2. Mol. consts. are evaluated. N. M. B.

Electronic states of diatomic carbon, and the carbon–carbon bond. R. S. MULLIKEN (Physical Rev., 1939, [ii], **56**, 778—781).—It is shown that the λ 2300 C band (cf. preceding abstract) belongs very probably to the transition $\sigma_g^2\sigma_u\pi_u^4\sigma_g$, $^1\Sigma_u^+ \rightarrow \sigma_g^2\sigma_u^2\pi_u^4$, $^1\Sigma_g^+$. Approx. energies and internuclear distances for all low-energy states of C_2 and C_2^+ are predicted and tabulated. A comparison of C–C distances in polyat. C compounds with those in C_2 indicates that bonding to other atoms helps to shorten C·C and C⁚C bonds in polyat. compounds as compared with C_2. N. M. B.

Analysis of absorption spectra. I. Physico-chemical properties of vinyl (·CH⁚CH·) and divinyl (·CH⁚CH·CH⁚CH·) chromophoric groups. E. HERTEL and H. LÜHRMANN (Z. physikal. Chem., 1939, **B**, **44**, 261—285).—Theoretical. Relations between colour and physico-chemical properties of org. substances are discussed. "Variochromic activity" (V) is defined as the power of an atom or group to influence the absorption of a chromophore. The internal field effects produced by introducing styryl and phenylbutadiene groups is small, and so V is small (intermediate between H and halogen). The relation between internal field effects, absorption spectra, and V of vinyl and divinyl groups and their substituted derivatives is discussed with reference to available data. C. R. H.

Near ultra-violet absorption of substituted benzenes. A. L. SKLAR (J. Chem. Physics, 1939, **7**, 984—993).—Empirically the absorption of an org. compound is determined by (i) its skeleton of unsaturated bonds (A., 1937, I, 547) and (ii) the groups or radicals attached to the skeleton. To determine the effect of (ii) the long-λ electronic absorption bands of PhMe, NH_2Ph, PhOH, and PhF have been considered. Although the atoms attached to the nucleus are of consecutive at. no. the intensity of absorption does not vary regularly. Using the method of antisymmetric mol. orbitals the electric moment produced by migration of an electron from the radical into the ring is calc. This migration causes the destruction of the six-fold symmetry of C_6H_6 and a consequent intensification of ultra-violet absorption if the substituent radical has (*a*) a low ionisation potential, (*b*) a pair of non-bonding P electrons, and (*c*) a small ring–radical distance. W. R. A.

Ultra-violet absorption spectrum and fluorescence of benzidine vapour. A. T. VARTANIAN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 618—621).—For v.d. corresponding with 200—250° the long-λ region of absorption of benzidine (I) lies between 3100 and 2450 A. (max. 2650 A.); the short-λ region begins at 2300 A. Increase of v.p. causes the two regions to coalesce, forming a single broad absorption band, the long-λ limit being displaced to longer λλ. If the vapour is heated at 200° for 4 hr. NH_3 bands appear. The fluorescence spectrum is a single intense band from 2950 to 4500 A. (max. 3700 A.). The violet luminescence becomes visible only at >120°. Increase in v.d. causes an increase in the intensity of fluorescence up to max. at 200°. Fluorescence is observed also in the solid state and in EtOH solution. The absorption spectra of NH_2-derivatives of C_6H_6 usually contain a region of absorption depending on electronic transitions in the substituent, but this has

not been observed for (I), owing probably to the small thickness of the absorbing layer and to the high temp. necessary to produce a sufficient v.d. W. R. A.

Ultra-violet irradiation of rubber. P. S. SRINIVASAN (Proc. Indian Acad. Sci., 1939, **10**, **A**, 186—196).—The absorption of light by rubber dissolved in polar [menthol, $(CH_2Cl)_2$] and non-polar solvents (*cyclo*hexane, C_7H_{16}) has been measured before and after ultra-violet irradiation in the absence of air. In polar solvents irradiation increases the absorption, whilst in non-polar solvents the solution becomes more transparent. This phenomenon is tentatively explained by assuming that the rubber mol. is highly polymerised in non-polar solvents and is depolymerised in polar solvents. Ultra-violet light produces both polymerisation and depolymerisation of rubber, according as the rubber is initially in a low or high state of polymerisation. This conception finds support in η data. W. R. A.

Absorption spectra of tocopherols, chromans, coumarans, and related compounds.—See A., 1939, II, 557.

Excitation function of bands of the first positive system of the nitrogen molecule. R. BERNARD and (MLLE.) R. FOUILLOUZE (Compt. rend., 1939, **209**, 647—650).—The excitation function (*I*) has been determined by intensity measurements on the 6546, 6323, and 6071 A. band-heads in N_2 bombarded with 9—30-v. electrons. *I* is max. at 13·5 e.v.; it is independent of pressure, and of the presence of He or Ne. A. J. E. W.

Band spectrum of indium hydride. B. GRUNDSTRÖM (Z. Physik, 1939, **113**, 721—729).—The analyses of the $^1\Pi—^1\Sigma$ and $^1\Sigma^*—^1\Sigma$ systems in the form of term schemes for the ground state $^1\Sigma$ and the excited states $^1\Pi$ and $^1\Sigma^*$ are given, and the $^1\Pi—^1\Sigma$ system of InH is compared with the $^2\Pi—^2\Sigma$ system of MgH, which it resembles. Both the InH bands exhibit predissociation. L. G. G.

Line widths of the HCl bands. E. LINDHOLM (Z. Physik, 1939, **113**, 596—606; cf. A., 1939, I, 449). —Line widths for the 4—0 band at 9152 A. are compared with those calc. theoretically. The widths of pure rotation lines are also calc., leading to agreement between quantum mechanical intensities of the rotation lines and Czerny's measurements. L. G. G.

Absorption spectra of neodymium sulphate in light and heavy water. O. FIALKOVSKAJA and S. KATSCHENKOV (Acta Physicochim. U.R.S.S., 1939, **10**, 579—582).—Comparison of the absorption spectra of $Nd_2(SO_4)_3$ in H_2O and D_2O shows that for D_2O the bands are shifted towards the violet, the shift decreasing with rise of temp. F. J. G.

Line absorption spectra of rare earth ions in crystals. E. J. MEEHAN and G. C. NUTTING (J. Chem. Physics, 1939, **7**, 1002—1011).—Absorption spectra of cryst. $M_2(SO_4)_3,8H_2O$ (M = Er, Dy, Ho, Tm) have been photographed from 14° to 300° K. For the low temp. the crystals were immersed in suitable liquids (14° or 20° K., H_2; 78° K., N_2; 169° K., C_2H_4). The variation in intensity of the absorption lines with temp. indicates energy levels at 19, 41, and 86 cm.$^{-1}$ > the normal state of $Er^{\cdots}$, and at 22 and 57 cm.$^{-1}$ > the lowest levels of $Dy^{\cdots}$. Such low energy levels have not been found for $Ho^{\cdots}$ and $Tm^{\cdots}$. The effect of temp. on the positions of the lines in the different spectra is discussed. W. R. A.

Near infra-red absorption spectra of pentaerythritol and diketopiperazine obtained with plane polarised light. J. W. ELLIS and J. BATH (J. Chem. Physics, 1939, **7**, 862—868).—The absorption of plane polarised light of λ 1—2·5 μ. by cryst. $C(CH_2{\cdot}OH)_4$ (I) and diketopiperazine (II) has been studied. The absorption depends on the orientation of the plane of oscillation of the electric vector E_0 to the crystal axes (pleochroism). In (I) the unperturbed OH band near 1·44 μ. is absent, and a twofold band with max. at 1·51 and 1·58 μ., due to perturbed OH, is found instead of the single band at ~1·6 μ. predicted by the accepted *X*-ray structure (A., 1937, I, 448). The band is modified when E_0 oscillates along the *c* axis. Hence not all the OH groups can be oriented at right angles to this axis. The region of CH_2 absorption near 1·7 μ. shows marked pleochroism, and indicates Fermi resonance between the first asymmetric valency overtone $2\nu_\sigma$ and the third deformation overtone $4\delta_\pi$. (II) shows no NH absorption near 1·50 μ., in agreement with Corey's assumption (A., 1938, I, 441) of electron resonance between four different structures. L. J. J.

Absorption spectra in the near infra-red of thick layers of benzene derivatives. K. RUMPF and R. MECKE (Z. physikal. Chem., 1939, **B**, **44**, 299—312).—Data obtained with layers 1—3 m. in thickness are recorded (0·7 to 1 μ.) and discussed. The H atoms in the C_6H_6 ring are not in the plane of the ring. The C–H valency coupling in C_6H_6 is weak, whilst the C–H bond is slightly strengthened by substituting NO_2 or OH and weakened by substituting NH_2 or Me. Combination bands with ring frequencies 1000, 1250, 1430, and 1600 cm.$^{-1}$ were observed. C. R. H.

Infra-red absorption of gaseous cyanogen. C. R. BAILEY and S. C. CARSON (J. Chem. Physics, 1939, **7**, 859—862).—Bands are recorded at $\lambda\lambda$ 3·755, 3·901, 4·651, 4·778, 13·65, and 16·18 μ. Complete transmission is found between 17 and 26·5 μ. L. J. J.

Infra-red absorption spectra of mono-substituted naphthalenes. Symmetry of naphthalene. J. LECOMTE (J. Phys. Radium, 1939, [vii], **10**, 423—427).—A detailed account of work already noted (A., 1939, I, 403). W. R. A.

Spectroscopic determination of the carbon–chlorine distance in methyl chloride. G. B. B. M. SUTHERLAND (J. Chem. Physics, 1939, **7**, 1066).—Polemical. Re-interpretation of the data of Nielsen and Nielsen (A., 1939, I, 509) gives a val. of the C–Cl distance closer to that obtained from electron diffraction data. W. R. A.

Absorption of multimolecular films in the infra-red. G. B. B. M. SUTHERLAND and W. T. TUTTE (Nature, 1939, **144**, 707).—With a film of Me stearate 700 mols. thick, the 3·3 μ. band is easily detectable, showing ~30% absorption; weaker bands are

noticeable between 6 and 10 μ. A film 200 mols. thick still gives the 3·3 μ. band with appreciable intensity. Absorption spectra can thus be obtained from $\sim 10^{17}$ instead of 10^{19} mols. L. S. T.

High-frequency perpendicular fundamental vibration of the ammonia molecule. G. B. B. M. SUTHERLAND (Physical Rev., 1939, [ii], **56**, 836—837).—Evidence is advanced in favour of a val. $\sim$3450 rather than $\sim$3415 cm.$^{-1}$ proposed by Barker (cf. A., 1939, I, 299). N. M. B.

Infra-red absorption by hydrogen selenide, and di- and mono-deuterium selenide. D. M. CAMERON, W. C. SEARS, and H. H. NIELSEN (J. Chem. Physics, 1939, **7**, 994—1002).—Examination of the infra-red spectra of H_2Se, D_2Se, and HDSe yields the following vals. (in cm.$^{-1}$) for the three fundamental $\nu\nu$, respectively: $\nu_1 = 2260$, 1630, 1691; $\nu_2 = 1074$, 745, 905; $\nu_3 = 2350$, 1696, 2352. Assignments have been verified by application of the Redlich product rule for isotopic analogues. The H—H and H—Se distances are 2·3 and 1·6 A., respectively, and the angle H–Se–H is slightly $>90°$; force consts. have been evaluated. W. R. A.

Infra-red spectrum and molecular constants of nitric oxide. A. H. NIELSEN and W. GORDY (Physical Rev., 1939, [ii], **56**, 781—784).—Measurement under high dispersion gave almost complete resolution of the fundamental at 5·3 μ. The absorption in this region comprises two superposed bands arising from a $^2\Pi_{1/2,\,3/2}$ electronic ground state. In the P and R branches many of the lines split up into doublets, the components of which belong to these two bands, respectively. An experimental % absorption–frequency curve is compared with a theoretical intensity curve of the bands. Consts. are re-calc. and compared with results from electronic band spectra. $r_0 = 1·15$ A. N. M. B.

Normal vibrations and configuration of hydrazine. II. Infra-red spectrum of hydrazine. W. FRESENIUS and J. KARWEIL (Z. physikal. Chem., 1939, **B**, **44**, 1—13).—The infra-red spectrum of N_2H_4 has been determined. V.p. data from 20° to 120° are also given, and marked association, probably to double mols., is indicated. From a comparison of the infra-red and Raman spectra the only possible configuration is the unsymmetrical one proposed by Penney and Sutherland (A., 1934, 1158), and from the normal frequencies assigned on this basis the mol. heat is calc. in agreement with observation. Free rotation does not occur; the Raman line 749 cm.$^{-1}$ corresponds with a twisting vibration about the N–N linking. F. J. G.

Oscillation frequencies of nitrites. D. WILLIAMS (J. Amer. Chem. Soc., 1939, **61**, 2987—2990).—The infra-red absorption spectra of 3N-$NaNO_2$ and -KNO_2 are each characterised by three max. at 7·6, 8·2, 13·3 and 7·7, 8·2, 13·4 μ., respectively. The long-λ band of $NaNO_2$ shows an asymmetry which is not exhibited by the corresponding band of KNO_2. Two possible assignments are discussed, and tested by means of central-force and valency-force approximations. On the central-force systems the assignment, $\nu_1 = 1320$, $\nu_2 = 750$, $\nu_3 = 1220$ cm.$^{-1}$, gives satisfactory vals. for force consts. with an angle of 86°; cf. 130° determined from X-ray measurements by Zeigler (A., 1931, 1218). The force consts. and valency angles of NO_2 gas, NO_2-group, and NO_2' are compared and the spectrum of HNO_3 is discussed. W. R. A.

Fluorescence of diacetyl: quantum yield and quenching by iodine. H. Q. FULLER, L. W. PHILLIPS, and G. M. ALMY (J. Chem. Physics, 1939, **7**, 973).—Quantum yields of 0·033, 0·0058, and 0·029 are recorded for fluorescence produced by irradiation of Ac_2 with $\lambda\lambda$ 4358, 4047, and 3650 A., respectively. The low val. for 4047 A. may be due to predissociation. The effective cross-section for quenching by I is 50—100 times that for O_2. The quenching effect of I decreases with continued irradiation as the I is used up. L. J. J.

Influence of temperature on the ultra-violet luminescence spectrum of sodium and potassium chloride crystals. M. N. PODASCHEVSKI and A. M. POLONSKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 332—333).—At −180°, 15°, and 100°, respectively, NaCl and KCl coloured by irradiation with an Al spark or X-rays have luminescence max. at 244, 249, 252 mμ. (NaCl), and 270, 280, 286 mμ. (KCl). The bands are broader and the max. intensity is smaller at the higher temp. L. J. J.

Proportionality of luminescence of zinc sulphide phosphors to irradiation at low intensities. J. H. GISOLF and F. A. KRÖGER (Physica, 1939, **6**, 1101—1111).—Deviations from proportionality to intensity of irradiation in the luminescence of ZnS–Cu, ZnS–Ag, and ZnS–MnS phosphors can be explained by the simultaneous effects of fluorescence and phosphorescence emission bands in different spectral regions. The phosphorescence is subject to saturation with increasing irradiation, and to the effect of temp. quenching of metastable states. L. J. J.

Application of the new analysis of molecular spectra to some interesting molecules. H. DESLANDRES (Compt. rend., 1939, **209**, 612—616; cf. A., 1939, I, 121).—An analysis of the Raman spectra of PH_3, PD_3, H_2, HD, D_2, C_6H_6, and C_6D_6 is discussed with reference to electron excitation and the grouping of atoms in the mols. A. J. E. W.

Optical catalysis of the Raman effect and a new technique for its production. K. PROSAD and D. K. BHATTACHARYA (Z. Physik, 1939, **113**, 637—659).—Absorption and fluorescence bands are photographed for a no. of substances containing small quantities of $KMnO_4$ and $Er(NO_3)_3$ as optical catalyst. The differences between the frequencies of the absorption and fluorescence bands show good agreement with known Raman displacements for the various solvents used for the optical catalyst. L. G. G.

Nature of the low-frequency Raman spectrum and the spectrum of hexamethylbenzene crystal. E. F. GROSE and A. I. RASKIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 126—128).—Since cryst. C_6Me_6 contains one mol. per unit cell and the Raman spectrum contains two low-frequency displacements of 53 and 95 cm.$^{-1}$, the theory of Grosé and Vuks (A.,

1937, I, 283) regarding the origin of such displacements is supported and the theory of Sirkar is refuted.

W. R. A.

Low frequency scattering spectra in *para*-, *meta*-, and *ortho*-di-iodobenzenes. E. F. Grose and A. V. Korschunov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 328—331).—Single crystals of *p*-, *m*-, and *o*-$C_6H_4I_2$ give Raman lines at 15, 25, 115; 24, 79, 101; 23, 46, 74, 89, 100, 127 cm.$^{-1}$, respectively, ascribed to intermol. vibrations in the cryst. lattice.

L. J. J.

Raman effect in relation to crystal structure. I. Calcite and sodium nitrate. B. S. R. Rao (Proc. Indian Acad. Sci., 1939, **10**, **A**, 167—175).—The Raman spectra of single crystals of $NaNO_3$ and calcite have been investigated. Small crystals of $NaNO_3$ were examined in a dil. CCl_4 solution of I, contained in a glass tube fitted with a flat window. The I solution served as a filter and cut down reflections from crystal sides. For $NaNO_3$ $\nu\nu$ for the crystal are $>$ those for the molten state. In agreement with the theory of Bhagavantam and Venkatarayudu (A., 1939, I, 300) both substances give two lines due to lattice oscillations, at 94 and 185 cm.$^{-1}$ for $NaNO_3$, and at 155 and 282 cm.$^{-1}$ for $CaCO_3$. The vals. for $CaCO_3$ are $>$ those of $NaNO_3$ because of stronger cryst. forces, a fact which is reflected by the lower m.p. of $NaNO_3$. Lattice forces do not appear to have a marked effect on the internal $\nu\nu$ of the NO_3 and CO_3 groups.

W. R. A.

Effect of crystal orientation on the Raman spectrum of sodium nitrate. T. M. K. Nedungadi (Proc. Indian Acad. Sci., 1939, **10**, **A**, 197—210).—Using a single $NaNO_3$ crystal 23 different spectrograms have been obtained by varying the orientation of the crystal to the direction of incident radiation, the direction of observation, and the state of polarisation of the incident and scattered radiations. The lattice $\nu\nu$ at 98 and 185 cm.$^{-1}$ appear, and the internal oscillations (720, 1065, and 1385 cm.$^{-1}$) of the NO_3' ion disappear (and vice versa), when polarised incident light is used with different crystal orientations and the scattered light is analysed. The lattice $\nu\nu$ are not found in the spectrum scattered longitudinally from unpolarised light incident along the optic axis. It appears, therefore, that these low-frequency oscillations arise from a torsional movement or tilt of the NO_3' ions in the lattice. The strong birefringence of $NaNO_3$ greatly influences the intensity of the internal oscillations. Possibly the NO_3' ion does not have trigonal symmetry in its own plane.

W. R. A.

Raman spectra of gaseous substances. I. Apparatus and the spectrum of methylamine. J. S. Kirby-Smith and L. G. Bonner (J. Chem. Physics, 1939, 7, 880—883).—A high-intensity Hg arc light source and arrangements for collecting scattered light are described. Data are recorded for excitation by Hg 4047 and 4358 A. The frequencies of the NH valency vibrations 3360 and 3470 cm.$^{-1}$ in the gas are $>$ those in the liquid spectrum by 50—100 cm.$^{-1}$, as compared with a max. shift of 12 cm.$^{-1}$ for the C–H vibrations; the NH effect is ascribed to intermol. H bonding in the liquid. The C–H bending frequency 1460 cm.$^{-1}$ is diffuse in the gas. An N–H bending vibration gives a weak line 781 cm.$^{-1}$, not found in the liquid. Four lines instead of two expected occur in the C–H valency region, possibly due to Fermi interaction. The C–N valency line 1044 cm.$^{-1}$, found in the liquid (and in infra-red absorption), is also found in the gas.

L. J. J.

Polarisation of Raman lines in relation to molecular structure: $SOCl_2$, MeCl, and BCl_3. K. Venkateswarlu (Proc. Indian Acad. Sci., 1939, **10**, **A**, 156—166).—The Raman displacements and depolarisation factors of the most prominent lines of $SOCl_2$, MeCl, and BCl_3 have been investigated. $SOCl_2$ has three polarised and three depolarised lines, indicating a planar structure in contradiction to the pyramidal structure suggested by Cabannes and Rousset (A., 1933, 446). MeCl has four polarised and two depolarised lines indicating a pyramidal structure. BCl_3 has symmetry D_{3h} and should have one polarised and two depolarised Raman lines; of these one polarised and one depolarised line only have been found.

W. R. A.

Raman effect and dipole moment in relation to free rotation. XI. Raman spectra of deutero-αβ-dibromoethanes. S. Mizushima, Y. Morino, and A. Suzuki (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 281—285; cf. A., 1938, I, 496).—Data are recorded for the Raman spectra of $(CD_2Br)_2$ (I), $(CH_2Br)_2$, and $CHDBr{\cdot}CD_2Br$. All the Raman lines of (I) given by the solid remain practically unchanged in the liquid, but additional lines due to deviation from the *trans*-configuration of the solid occur in the liquid.

L. J. J.

Theory of electrical breakdown of crystalline insulators. W. Franz (Z. Physik, 1939, **113**, 607—636).—A detailed account of work already noted (A., 1939, I, 510).

L. G. G.

Dielectric losses of irradiated zinc sulphide phosphors. J. H. Gisolf (Physica, 1939, **6**, 918—928).—Dielectric losses and changes of dielectric const. have been measured in alternating fields of frequency 1—15,000 kc. for ZnS–3%MnS phosphors irradiated in the different spectral absorption regions. No effect of irradiation is found with λ 4358 A. (in the Mn absorption region). With λ 3650 A. the difference (Δ) between the dielectric losses in the irradiated and unirradiated states has a max. at ~5 kc. and a min. between 100 and 1000 kc., indicating two superposed processes. With λ 3100 A., Δ increases with ν to a nearly const. val. at ~100 kc., giving a mean absorption coeff. $\sim 5 \times 10^4$ cm.$^{-1}$ The results indicate bimol. recombination in the region of ZnS crystal absorption, accompanied at λλ >3350 A. by the phosphorescence process.

L. J. J.

Amorphous state. XII. Dielectric relaxation in amorphous phenolphthalein. E. Kuvschinski and P. Kobeko (Tech. Phys. U.S.S.R., 1938, **5**, 401—409).—The variation with time of the dielectric const. ϵ in amorphous phenolphthalein has been measured from 75° to 110°. At 75° ϵ varies little with time but at higher temp. it rises rapidly to a const. high val. The final val. is practically independent of temp. and varies with time according to the law $\epsilon = \epsilon_0(\epsilon_0 - \epsilon_\infty)/$

$(1 + t/n)^m$. Dielectric relaxation is closely connected with elasticity, and indirectly with viscosity.
F. J. L.

Dimorphism of long-chain n-alcohols. K. HIGASI and M. KUBO (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 286—300).—Cetyl alcohol (m.p. 49·1°) and octadecyl alcohol (m.p. 57·7°) have transition points, detected by thermometric, dilatometric, and dielectric const. measurements, at 42·4°, 44·5°, 44° and 52·8°, 54·5°, 55°, respectively. The high-temp. forms have lower ρ, amorphous appearance, and higher conductivity and dielectric const. The last-named varies markedly with frequency and this effect is ascribed to formation of micelles, with a large electric moment, which can rotate about the chain axes.
L. J. J.

Calculation of absorption by the Drude–Coolidge method. H. SLÄTIS (Ann. Physik, 1939, [v], **36**, 397—412).—A method for measuring the absorption coeff. of a dielectric in a condenser with the Drude–Coolidge apparatus is described. The ratio of the max. galvanometer throws, with and without the condenser, in a Lecher system is used, and the resonance curve is not required. The method gives satisfactory results when tested with $Pr^{\alpha}OH$ and shellac.
A. J. M.

Theory of dielectric polarisation in liquids. K. ZAKRZEWSKI and A. PIEKARA (Nature, 1939, **144**, 250).—Onsager's theory (A., 1936, 1182) is criticised, and his formula relating μ (vapour) to ϵ and n_∞ (liquid) is modified to be more in accordance with the assumptions of the theory. The corr. formula gives less satisfactory agreement with experiment (15% low; cf. Böttcher, A., 1939, I, 126).
L. S. T.

Dielectric polarisation of polar liquids. J. G. KIRKWOOD (J. Chem. Physics, 1939, **7**, 911—919).—Theoretical. A generalisation of the Onsager theory is presented, in which the dielectric const. ϵ is related to the dipole moment (a) of a single mol. and (b) of a mol. and its neighbours in the absence of an external field. The theory is applied to tetrahedrally co-ordinated H_2O, and Onsager's val. of 31 for ϵ of liquid H_2O at 25° is brought into close agreement with the observed val. 79.
L. J. J.

Dipole variation of ether. N. C. C. LI (J. Chem. Physics, 1939, **7**, 1068).—The prediction of Byers (A., 1939, I, 242), that the electric moments of unsymmetrical ethers will vary in a manner similar to the cellosolves and alcohols, has been confirmed by dipole moment, *D*, measurements. An initial decrease in *D* from EtOH to Et_2O, and from PhOH to PhOMe, is due to the increased repulsion over that between H and the Et or Ph group. Further lengthening of the chain (EtOBu, EtO·C_5H_{11}-*iso*, PhOEt, Ph_2O) does not alter the bulk of the chain near the O atom, and hence the moments are approx. const.
W. R. A.

Dielectric constant and dipole moment of aluminium bromide. V. A. PLOTNIKOV, I. A. SCHEKA, and Z. A. JANKELEVITSCH (J. Gen. Chem. Russ., 1939, **9**, 868—879).—The dielectric const. of $AlBr_3$ at temp. θ (100—240°) is given by $\epsilon = 3{\cdot}375 - 0{\cdot}003(\theta - 100)$. In Br or CS_2 solution ϵ rises linearly with increasing [$AlBr_3$]; in C_6H_6 the ϵ–concn. curve is sigmoid. The dipole moment is zero for liquid $AlBr_3$, for its solutions in Br or CS_2, and for its conc. C_6H_6 solutions; this is consistent with its existence as symmetrical Al_2Br_6 mols. The presence of solvated $AlBr_3$ mols. in dil. C_6H_6 solutions is postulated.
R. T.

Constancy of the valency angles of the carbon tetrahedron. Dipole moments of stereo-isomeric βγ-dichloro-Δ^β-butenes. G. P. MICHAILOV and D. V. TISCHTSCHENKO (J. Gen. Chem. Russ., 1939, **9**, 782—787).—In disubstituted ethylenic and aromatic compounds the isomeride of higher b.p. has the higher dipole moment. μ of *cis*-$(CMeCl)_2$ calc. from that of *cis*-$(CHCl)_2$ on the assumption that deformation of the valency angles is absent agrees well with that found experimentally.
R. T.

Dipole moment of the aminobenzoic acids in dioxan. L. VAN BLARICOM and E. C. GILBERT (J. Amer. Chem. Soc., 1939, **61**, 3238—3239).—In H_2O *o*-, *m*-, and *p*-NH_2·C_6H_4·CO_2H occur to some extent as zwitterions, but they are practically insol. in non-polar solvents. In dioxan their dipole moments are $\gg$ those of their Me esters (cf. A., 1928, 1309) contrary to expectation.
W. R. A.

Dipole moments and structures of ozone, silicobromoform, and dichlorogermane. G. L. LEWIS and C. P. SMYTH (J. Amer. Chem. Soc., 1939, **61**, 3063—3066).—For O_3 in liquid O_2 the dipole moment is 0·49 D., indicating that O_3 is triangular with an angle of ~140° and that there is resonance between different structures containing semi-polar bonds. $SiHBr_3$ (in C_7H_{16}) and GeH_2Cl_2 (in CCl_4) give 0·79 and 2·21 D., respectively. An explanation is offered of the min. vals. of the Si compounds in series of analogous C, Si, Ge, and Sn compounds, which otherwise increase in the order named.
W. R. A.

Dipole moments and structures of certain nitro-compounds and amines. G. L. LEWIS and C. P. SMYTH (J. Amer. Chem. Soc., 1939, **61**, 3067—3070).—The dipole moments of $C(NO_2)_4$, $CH(NO_2)_3$, and N_2O_5 in CCl_4, and of *cyclo*hexylamine (I) and morpholine (II) in C_6H_6, have been measured. $C(NO_2)_4$ has zero moment but has high at. polarisation. $CH(NO_2)_3$ is tetrahedral. The moment of N_2O_5 is 1·39 D., indicating, contrary to electron diffraction data (A., 1934, 835), that the mol. is non-linear. The NO_2–O–NO_2 angle is estimated as 145°. (I) gives 1·32 D., a val. approx. that of primary alkylamines. The moment of (II) is 1·58 D., which suggests the *Z* structures but does not completely exclude the alternative *U* structures.
W. R. A.

Dipole moment and alkyl chain length. H. O. JENKINS (Nature, 1939, **144**, 667—668).—In the series C_6H_6, PhMe, PhEt, and PhBu, the relation between μ and $1/r^2$, where r is the distance between the C of the ring and the terminal C (H in the case of C_6H_6), is linear.
L. S. T.

Skew structure of benzil. C. C. CALDWELL and R. J. W. LE FÈVRE (J.C.S., 1939, 1614—1622).—The dipole moments of benzil in decalin (const. from 25° to 90°) and other solvents, and of phenanthraquinone, acenaphthaquinone, and Ac_2, mostly in C_6H_6, are

recorded. These data indicate that the Ph rings in benzil are approx. at 90° to each other (cf. A., 1939, I, 458). Ac_2 appears to be more flexible or more *trans* in type. R. S. C.

Influence of rotation hindrance and anisotropy of the inner field on the polarisation of liquids. A. PETERLIN and H. A. STUART (Z. Physik, 1939, **113**, 663—696).—Theoretical. The simultaneous influence of rotation hindrance and the anisotropy of the inner field on the polarisation and artificial birefringence of liquids is calc. Results are exemplified in certain practical instances. L. G. G.

Polarisations and related data of optically active and racemic β-octanol.—See A., 1940, II, 3.

Optical activity dependent on the planar arrangement of the valencies of the 4-co-ordinated palladous atom.—See A., 1940, II, 8.

Rotatory dispersion and absorption spectra of carboxylic acids and hydrocarbons containing a phenyl or *cyclo*hexyl group. A. ROTHEN and P. A. LEVENE (J. Chem. Physics, 1939, **7**, 975—983).—In disubstituted acids containing a Ph group, absorption bands are shifted to an extent depending on the distance between the Ph and CO_2H groups. The first active absorption region of phenylated acids has been allocated from measurements of the rotatory dispersion (cf. A., 1934, 12) in C_7H_{16} of configurationally related acids. The vicinal effect of the Ph on the partial rotation of the CO_2H has been studied and is similar to that of n-C_6H_{13} or *cyclo*hexyl groups, possibly because the longer-λ absorption bands of the Ph are not optically active. W. R. A.

Magneto-optic and natural dispersions of *iso*butyl butyrate and ethylene dichloride. W. J. G. BEYNON (Phil. Mag., 1939, [vii], **28**, 548—561).—From 0·31 to 0·43 μ. the magneto-optical dispersions are given by $\phi = n\delta\lambda^2 = K_1\{\lambda^2/(\lambda^2 - \lambda_1^2)\}^2$, where $\delta =$ Verdet's const., $\lambda_1 =$ wave-length of the absorption band, and K is a const. for the liquid. The natural dispersion of $Pr^{\alpha}CO_2Bu^{\beta}$ is given by $n^2 - 1 = 0{\cdot}95409 + 0{\cdot}009642/(\lambda^2 - \lambda_1^2)$; n for $(CH_2Cl)_2$ cannot be expressed similarly. Magneto-optical and natural dispersions appear to be independent of absorption bands in the infra-red. Calc. vals. of e/m are $<$ the accepted val. for electrons, although the results indicate that the resonators controlling the dispersion have an electronic nature. λ increases on passing from $Pr^{\alpha}CO_2Et$ to $Pr^{\alpha}CO_2Pr^{\beta}$ and on to $Pr^{\alpha}CO_2Bu^{\beta}$ (~12 A.). T. H. G.

Rotation–vibration energies of tetrahedrally symmetric pentatomic molecules. I. W. H. SHAFFER, H. H. NIELSEN, and L. H. THOMAS (Physical Rev., 1939, [ii], **56**, 895—907; cf. A., 1939, I, 511).—Mathematical. A complete theory to second degree of approximation for certain vibration states is derived. The selection rules governing transitions are determined with relations for the intensities. N. M. B.

Expanded secular equation for the vibration frequencies of a molecule. E. B. WILSON, jun. (J. Chem. Physics, 1939, **7**, 1047—1052).—Mathematical. The secular equation is obtained in an algebraic form rather than as a determinant, and methods of obtaining approx. roots are discussed. W. R. A.

Vibrational spectra of αβ-dihalogenoethanes and internal rotation. T. Y. WU (J. Chem. Physics, 1939, **7**, 965—970).—Potential functions for internal rotation in αβ-dihalogenoethanes derived from temp.-variation of electric moments predict a negligible proportion of *cis*-form in the liquids. The high proportion of *cis*-form indicated by infra-red and Raman spectra may be due to reduction of the potential energy difference between *cis*- and *trans*-forms as a result of the high dielectric const. of the liquid, or to a failure to conform to the Boltzmann equilibrium ratio. L. J. J.

Theory of rotational transformations. K. SCHÄFER (Z. physikal. Chem., 1939, **B**, **44**, 127—162).—The theory developed is based on the common orientation of coupled rotators; it accounts for the anomalous displacement of the lower transformation temp. of CD_4 in presence of CH_4, and the phenomenon of thermal hysteresis. A. J. E. W.

Molecular distribution in liquids. J. G. KIRKWOOD (J. Chem. Physics, 1939, **7**, 919—925).—Theoretical. A radial distribution function, not based on random displacement of mols. from their positions in a regular lattice, is developed for non-polar liquids. A single parameter, the work of formation of a cavity of mol. size, is employed. L. J. J.

Density distribution and energy spectrum of *B*-electrons. III. Frame model [for the aromatic nucleus]. (Cylinder-ring, compression of *B*-electrons.) O. SCHMIDT and H. SCHMIDT (Z. physikal. Chem., 1939, **B**, **44**, 185—193; cf. A., 1938, I, 298; 1939, I, 183).—The structure of C_6H_6 developed previously is applied to higher cyclic compounds of the C_nH_n series. The model leads to the conclusion that C_8H_8 should show no aromatic characteristics, but that these should reappear with $C_{10}H_{10}$, in accord with Hückel's theory (A., 1931, 1000). J. W. S.

Spectral emissivity of alloys at 0·65 μ.—See B., 1939, 1251.

Electronic formulæ of double and triple linkings. V. A. ISMAILSKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 658—662).—Theoretical. W. R. A.

Ellipsoids of polarisation of bonds and octets. S. N. WANG (J. Chem. Physics, 1939, **7**, 1012—1015).—The transverse and longitudinal polarisabilities of C–Cl and C–Br octets, C⁚C, C⁝C, and aromatic C–C bonds, and the polarisation ellipsoid of the O octet in Me_2O have been evaluated from Kerr consts. and the degrees of depolarisation of compounds in the gaseous state. The vals. show a greater regularity than those calc. by Sachsse (A., 1935, 810) from his measurements on solutions. W. R. A.

Mesomerism and orientation. G. BADDELEY (Nature, 1939, **144**, 444).—Illustrations are given of the more general application of the view that many of the anomalies associated with *o*-substituents (" *ortho* effects ") find an explanation in the steric hindrance of resonance discussed by Ingham and Hampson (A., 1939, I, 405). L. S. T.

Electronic energy bands in metallic tungsten. M. F. MANNING and M. I. CHODOROW (Physical Rev., 1939, [ii], **56**, 787—798; cf. A., 1938, I, 14).—Mathematical. Calculations by the Wigner–Seitz–Slater method are given and discussed. The electronic contribution to the sp. heat is calc. for Ta and W, and results agree with the excess sp. heat at high temp. for both metals, but not at low temp. for Ta. Qual. discussions of the differences in electrical resistance, temp. coeff. of resistance, and thermoelectric power of W and Ta are given. The contribution of exchange effects to the paramagnetic susceptibility is examined. N. M. B.

Physical interpretation of crystallographic ionic radii. H. JENSEN (Angew. Chem., 1939, **52**, 583—586; cf. A., 1938, I, 559).—From the electron distribution according to the Thomas and Fermi atom model, and assuming that the relative at. radii in a crystal adjust themselves so that the total electronic energy is a min., the individual ionic radii in the crystal lattices of the alkali halides are deduced. It is shown that the assumption of a const. ionic radius, although not essential according to wave-mechanical theory, is actually an approximation which accords with the theoretical interpretation of lattice dimensions. J. W. S.

Calculation of energy of repulsion. M. F. MAMOTENKO (Acta Physicochim. U.R.S.S., 1939, **11**, 225—238).—The approx. method previously described (A., 1939, I, 177) is further applied to the lattice energies of Ne and A and the compressibility of the A lattice. F. L. U.

Ferromagnetism of impurity semi-conductors. T. MUTO (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 271—280).—A quantum-mechanical discussion of the anomalous temp.-variation of ferromagnetism in impurity semi-conductors such as pyrrhotite (Fe + S) and Cr + S crystals, as compared with ordinary ferromagnetics. L. J. J.

Differential method applied to the surface ionisation of sodium halides on tungsten. A. A. JOHNSON and T. E. PHIPPS (J. Chem. Physics, 1939, **7**, 1039—1046).—A differential mol. beam method for the study of surface ionisation of salts has been developed. Reference and working filaments, the former at const. temp., were placed in a mol. beam path, and the ratio of the two positive ion currents was measured by means of a centre-tap galvanometer (described). The influence of temp. and field strength on the degree of ionisation of NaX (X = Cl, Br, I) on W and W–O surfaces has been measured, and a comparison with vals. calc. from simple theory discloses certain discrepancies which can be explained by assuming that active areas of W covered with X exist, even up to 2600° K., and that NaX mols. are completely ionised on striking these active areas. W. R. A.

Parachor of aluminium bromide in benzene. I. POPPICK and A. LEHRMAN (J. Amer. Chem. Soc., 1939, **61**, 3237—3238).—The parachor of C_6H_6 solutions of $(AlBr_3)_n$ (from 0·017 to 0·083 mol. fraction Al_2Br_6), when extrapolated to 100% solute using the formula of Hammick and Andrew (A., 1929, 628), gives 232·9 ($AlBr_3$), 470·4 (Al_2Br_6), and 703·2 (Al_3Br_9), in good agreement with Sugden's vals. for molten $(AlBr_3)_n$, 228·8, 457·6, and 686·4, respectively. This indicates that the formula of $(AlBr_3)_n$ in C_6H_6 solutions is the same as for the molten compound. Conc. C_6H_6 solutions of $(AlBr_3)_n$ gradually separate into two layers, the denser being a red oil, probably $Al_2Br_6,6C_6H_6$. W. R. A.

Single-crystal *X*-ray diffraction pattern of calcite. F. MILLER, jun. (Physical Rev., 1939, [ii], **56**, 757—764).—A reconsideration of Smith's method of analysis of double-spectrometer rocking curves (cf. A., 1934, 1149) shows that instead of six rocking curves for calcite, the (1, +1) and (2, +2) curves should be sufficient for the deduction of the shape of the single-crystal diffraction pattern. A method of modifying the equations of the instrument to allow for a simple type of mosaic structure is indicated, and the equations are applied to rocking curves of Mo $K\alpha_1$ from calcite. N. M. B.

Theory of *X*-ray scattering by particle clusters. R. HOSEMANN (Z. Physik, 1939, **113**, 751—768).—Theoretical. From the theory of scattering of *X*-rays for a single particle (ellipsoid of rotation) it is shown that the intensity distribution in the "central spot" is unrelated to the particle type, *i.e.*, micelle, crystallite, etc. The actual blackening distribution of the central spot leads to an abundance distribution of particle lengths and thicknesses from which the aggregation diagram is obtained. By means of the latter, investigation of the sub-microscopic structure of materials is made possible. L. G. G.

Interference curves on *X*-ray rotation photographs. A. KITAIGORODSKI (Tech. Phys. U.S.S.R., 1938, **5**, 383—390).—Interference curves have been classified and their equations determined. It is shown that with their use four oscillation photographs are sufficient to determine the Bravais lattice and that a special camera is not necessary. F. J. L.

Crystal structure and magnetic behaviour of metallic holmium. H. BOMMER (Z. anorg. Chem., 1939, **242**, 277—280).—*X*-Ray measurements give a hexagonal closely packed lattice for Ho, *a* 3·557±0·003, *c* 5·620±0·005 A., *d* 8·764, at. vol. 18·65 c.c. Vals. of χ in the temp. range 90—515° K. show that the Curie–Weiss law is obeyed. The calc. magnetic moment is 10·6 Bohr magnetons. O. J. W.

Effect of temperature on the structure of mercury. R. N. BOYD and H. R. R. WAKEHAM (J. Chem. Physics, 1939, **7**, 958—962).—Diffraction patterns of liquid Hg at −36° to 250° have been obtained with ZrO_2-filtered Mo $K\alpha$ radiation at an angle of incidence 4° 11′ to the Hg surface. A new peak at a diffraction angle of 10° is recorded. At. distribution functions, showing shifting and broadening of the max. with increasing temp., are deduced. L. J. J.

Atomic parameters of γ-silver–cadmium. H. PERLITZ and R. AAVAKIVI (Nature, 1939, **144**, 708—709, and Acta Comm. Univ. Tartu., 1939, **A**, **35**, 13 pp.).—The at. parameters calc. by the method of successive approximations, based on *X*-ray powder photographs, give intensities in agreement with those

observed experimentally. The parameters are *a* 0·105, *b* 0·175, *c* 0·358, *d* 0·310, and *e* 0·038, and give calc. interat. distances which suggest a regular distribution of the Ag and Cd atoms, Ag occupying positions of *B* and *C* atoms, and Cd those of *A* and *D* atoms. L. S. T.

X-Ray examination of titanium nitride. I. Single-crystal investigation. A. BRAGER (Acta Physicochim. U.R.S.S., 1939, **10**, 593—600).—*a* for TiN is 4·22 A. ρ by pyknometer is 4·73, as against the calc. val. 5·43. Possible causes for the discrepancy are discussed. F. J. G.

Structure of ferromagnetic ferric oxide, γ-Fe_2O_3. R. HAUL and T. SCHOON (Z. physikal. Chem., 1939, **B**, **44**, 216—226).—The vals. of the a_w lattice const. for specimens of γ-Fe_2O_3 prepared from Fe_3O_4, from the Fe arc, and from $Fe(CO)_5$ are all in approx. accord with the val. 8·32 A. observed by Hägg (A., 1935, 920) and < the accepted val. of 8·4 A. The (111) interferences, the absence of which has usually been attributed to unoccupied positions in the Fe lattice, have been observed, as have a further series of new lines, in both the *X*-ray and electron diffraction patterns. The results are discussed with reference to the possible space-groups in the lattice. J. W. S.

X-Ray diffraction in liquid ethyl alcohol. G. G. HARVEY (J. Chem. Physics, 1939, **7**, 878—880). —The diffraction of monochromatic Mo *Kα* radiation by liquid EtOH has been studied at 25° and —75°, and the atom distribution curve obtained by Fourier analysis. The C—C and C—O distances give a single peak at ~1·5 A., and distinct peaks occur at ~2·4 A. and ~2·9 A., due to a second intramol. C—O distance and to intermol. OH bonds, respectively. L. J. J.

Crystalline form of alkali arsanilates. G. GILTA (Bull. Soc. chim. Belg., 1939, **48**, 315—325; cf. A., 1923, 407; 1925, 93).—The following crystallographic data are recorded for *p*-$NH_2{\cdot}C_6H_4{\cdot}AsO_3HX + nH_2O$: Na, $3H_2O$ $a:b:c$ 1·3158 : 1 : 0·7416, orthorhombic; Na, $5H_2O$ $a:b:c$ 2·1812 : 1 : 0·96016, β 91° 4′, monoclinic; Na, $6H_2O$ $a:b:c$ 2·48077 : 1 : 0·96257, β 97° 40′, monoclinic; Rb $a:b:c$ 0·77568 : 1 : 0·77288, orthorhombic; Cs, H_2O $a:b:c$ 2·35585 : 1 : 0·81440, orthorhombic; Cs, $3H_2O$ $a:b:c$ 2·2229 : 1 : 0·9784, β 96° 40′, monoclinic. The formula with $4H_2O$ usually given for atoxyl represents the approx. composition of the commercial product and does not correspond with a chemical individual. F. L. U.

(A) **Crystals of quartz glass. I.** (B) **Mosaic blocks of crystalline quartz.** N. A. SCHISCHAKOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 788—791, 792—793).—(A) The theory of Zachariasen (A., 1933, 12) does not agree with the structure of SiO_2 glass determined by electron diffraction. The presence of two-dimensional Si_2O_5 layers in SiO_2 glass is upheld.

(B) Considerations of the peptisation of quartz powder by H_2O indicate the presence of crevices (~6 A.) in the crystal, accounting for the facts that quartz can retain many regularly distributed inclusions, and that cations will travel through the mineral on application of a p.d. A. J. M.

Elementary regions of ferromagnetism. R. HAUL and T. SCHOON (Z. Elektrochem., 1939, **45**, 663—671).—The Fe_2O_3 aërosol particles formed on oxidation of $Fe(CO)_5$ vapour by O_2 at 200—735° (θ) are shown by *X*-ray and electron-diffraction data to occur in the γ-form. The variation with θ of the mean diameter (*d*) of the particles is studied; *d* is calc. from the electron-diffraction intensity distribution. At low θ *d* has a min. val. (~17 A.), corresponding with the min. size of the primary crystallites, and rises to ~70 A. for the higher θ vals. χ for the γ-Fe_2O_3 preps. rises slowly with *d* up to 30—40 A. and then increases rapidly to ferromagnetic vals. owing to spontaneous magnetisation of the particles. The incidence of the latter effect on transition from the *X*-ray amorphous state to an ordered lattice is due to co-operative action, 30—40 A. (~100 unit cells to the cube) being the min. *d* val. at which the effect can occur. A. J. E. W.

Internal rotation in ααβ-trichloroethane. A. TURKEVICH and J. Y. BEACH (J. Amer. Chem. Soc., 1939, **61**, 3127—3130).—From electron diffraction photographs $CH_2Cl{\cdot}CHCl_2$ is not a rigid *cis* or *trans* mol., nor is there a sinusoidal potential barrier to internal rotation with the *trans* the most stable configuration. The radial distribution function shows that the most stable configuration is rotated about 50° from the *trans* configuration. A potential barrier calc. from dipole and exchange interactions agrees with experiment. Assuming the C—C and C—H distances to be 1·54 and 1·09 A., respectively, the C—Cl distance is 1·75±0·03 A., and the Cl–C–Cl angle 111° 30′±2°. W. R. A.

Electron diffraction investigation of the molecular structures of the *meso* and racemic βγ-dibromobutanes. D. P. STEVENSON and V. SCHOMAKER (J. Amer. Chem. Soc., 1939, **61**, 3173—3176).—By electron diffraction measurements *r*- and *meso*-$(CHMeBr)_2$ have "*trans*" configurations with respect to the Br atoms, the Br—Br distance being 4·60±0·03 A. A structural model of these compounds, based on the known structure of $Pr^\beta Br$, gives a theoretical scattering curve which is compatible with the electron diffraction photographs. Considerable torsional oscillation about the equilibrium "*trans*" configuration is indicated. W. R. A.

Theory and applicability of electron interference measurements. I. Electron diffraction experiments. II. Applicability of electron interference measurements. T. SCHOON (Angew. Chem., 1939, **52**, 245—251, 260—262).—I. A general survey of the theory of electron diffraction. Details are given of the methods of determining at. and mol. separations in polycryst. substances, single crystals, and vapours, using slow and fast electrons.

II. Interat. distances in common vapours and gases are listed, and methods of measuring crystal size and lattice dimensions are discussed. Vals. of the inner potential of some metals and salts are recorded. There is a complete bibliography up to 1938. F. J. L.

Exchange interaction in magnetic crystals. W. OPECHOWSKI (Physica, 1939, **6**, 1112).—Errata (cf. A., 1937, I, 227). L. J. J.

Magnetic anisotropy of nickel at 20° K. H. J. WILLIAMS and R. M. BOZORTH (Physical Rev., 1939, [ii], **56**, 837).—In view of conflicting available data, the anisotropy consts. were measured at 77° and 20° K. by the method of torques. The ratio of the vals. is $\sim 1 \cdot 2 \pm 10\%$. Results are in agreement with theory and show that there is no unusual behaviour in the anisotropy at these temp. N. M. B.

Paramagnetic rotatory power and magnetisation of nickel fluosilicate hexahydrate in the direction of the optic axis. The crystal field. J. BECQUEREL and W. OPECHOWSKI (Physica, 1939, **6**, 1039—1056; see below).—The experimental data indicate a doubly degenerate fundamental state for Ni^{++}, followed at a spacing of 0·301 cm.$^{-1}$ by a non-degenerate state. Expressions are deduced for the magnetisation and magnetic rotation relations. The magnetic moment of the fundamental level along the optic axis and the limiting effective moment calc. from the thermal variation of the Verdet const. are 2·25 and 3·185 Bohr magnetons, respectively. *X*-Ray data indicate octahedral symmetry for the electric field acting on the Ni^{++} ion, with a less intense field of trigonal symmetry superposed. The splitting of the fundamental ^3F state of free Ni^{++} in the cryst. field is 19,200 cm.$^{-1}$ L. J. J.

Large anisotropy of the electrical conductivity of graphite. K. S. KRISHNAN and N. GANGULI (Nature, 1939, **144**, 667).—Well-developed single crystals of graphite from Ceylon have $\rho \sim 10^{-4}$ Ω. per cm. in the basal plane and 2—3 Ω. per cm. along the normal to this plane. Magnetic properties of graphite have been shown previously to be abnormal (A., 1936, 416). L. S. T.

Electrical breakdown strength of ionic crystals as a function of temperature. R. C. BUEHL and A. VON HIPPEL (Physical Rev., 1939, [ii], **56**, 941—947).—KBr single crystals show a very steep increase of breakdown strength with temp. from —80° to a max. at ~50°, followed by a decrease. NaCl showed similar results, contrary to accepted views for insulators. The phenomenon is apparently analogous to the temp. coeff. of resistance in metals, and is discussed in relation to available theories. N. M. B.

Electrical breakdown of rock-salt at high temperatures. A. WALTHER and L. INGE (Tech. Phys. U.S.S.R. 1938, **5**, 335—354).—The electrical breakdown of rock-salt is purely thermal, even in very non-uniform electrical fields, and when the specimen is submitted to short electrical impulses to reduce heating. The breakdown voltage is slightly lowered by the penetration of electrons into the crystal and by the growth of dendrites. The breakdown direction is crystallographically oriented, whereas the electron penetration, which usually takes place near the cathode, is not. F. J. L.

Anomalous physical properties of thin silver films. A. T. ASCHTSCHEULOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 122—125).—The absorption of light by Ag layers deposited on glass, fused quartz, NaCl and KCl crystals has been measured. For layers deposited on substrata kept at room temp., the selective absorption depends on the film thickness. On heated substrata " unstable " thick films with anomalous colouring and optical properties were obtained. These changed into normal films on keeping or on exposure to I or Br vapour. It is concluded that the anomalous properties are due to the colloidal structure of the layers and that the thinnest layers of Ag are also colloidal. Agreement with the Rayleigh–Mie theory was obtained and was confirmed by measurements on Au layers. W. R. A.

Optical anisotropy and the structure of cellulosic sheet materials. J. SPENCE (J. Physical Chem., 1939, **43**, 865—879).—The method of evaluation of the birefringence of sheet materials is described. The effects of sheet thickness, stretching, and length of the C side-chain on the birefringence of cellulose acetate, acetate propionate, acetate butyrate, butyrate, hexoate, heptoate, and octoate are discussed. J. W. S.

Magnetic rotatory power of hexahydrated nickel fluosilicate in the direction of the optic axis. Thermal variation down to liquid helium temperatures. J. BECQUEREL and J. VAN DEN HANDEL (Physica, 1939, **6**, 1034—1038).—The paramagnetic optical rotatory power (ω) of $NiSiF_6,6H_2O$ in the direction of the optic axis has been measured from ordinary to liquid He temp. and with field strengths up to 27,040 gauss. ω is positive and increases with decreasing temp. down to 1·607° K. At this temp. there is a marked approach to paramagnetic saturation. L. J. J.

Fields of stress connected with dislocations in a regular crystal lattice. I. II. Solutions of equations of elasticity for a non-isotropic substance of regular crystalline symmetry. J. M. BURGERS (Proc. K. Akad. Wetensch. Amsterdam, 1939, **42**, 293—325, 378—399). F. J. L.

Crystallisation by pulverisation. W. DEKEYSER and J. A. PRINS (Physica, 1939, **6**, 1009—1010).—Vitreous Se crystallises in the course of a few weeks when kept at 48° if previously powdered, but not otherwise. The change is unaffected by the atm. in contact with it. L. J. J.

Retardation of the development of an ordered structure between ordinary and crystalline liquids and between different types of the latter. C. WEYGAND and R. GABLER (Z. physikal. Chem., 1939, **B**, **44**, 69—74).—The clear point for 1-*p*-*iso*butoxybenzylideneaminonaphthalene-4-azobenzene is 22°, but by slow cooling the substance can be maintained optically clear and isotropic for days at 0°. By extrapolating transition point–composition curves for isomorphous mixtures, it is shown that in several cases where a liquid cryst. form might be expected, but is unknown, the transition point would fall in a region of very high η, so that the non-appearance of the expected form may be due to the slowness of the mol. rearrangement. F. J. G.

Conduction of electricity and diffusion in semi-metallic alloys. IV. Electrical conductivity and thermo-electric power of α-silver sulphide. H. REINHOLD and K. SCHMITT (Z. physikal. Chem., 1939, **B**, **44**, 75—97; cf. A., 1939, I, 137).—The sp. conductivity (κ) of α-Ag_2S is reduced in presence of free S,

and reaches a min. val. in saturated S vapour. The fall in κ is measurable at $p_S = 10^{-7} - 10^{-8}$ mm. At const. p_S (0·05—11 mm.) the log κ–$1/T$ isobars are linear, with a sharp break at 350°. Adsorption isotherms for S on α-Ag_2S are plotted for $T = 523$—673° K.; the adsorbed S is determined by heating at 200° in contact with Ag and weighing the additional Ag combined as Ag_2S. The adsorption isobars also have a break at 350°. The thermo-electric power of α-Ag_2S–S against Pt is determined ($p_S = 0·3$—83 mm.). The data show that conduction is of the electron-excess type, as κ is $\propto$ the electron concn. The excess electrons are derived from S″ ions above 350°, but below this temp. the results indicate an anomalous no. of free electrons per S″ ion. The temp. coeff. of κ with a const. [S] is negative, and approaches that for Ag_2S as p_S is reduced. A. J. E. W.

Magnetic properties of thin superconductive films. N. E. ALEXEEVSKI (Compt. rend. Acad. Sci. U.R.S.S., **24**, 28—31; cf. A., 1938, I, 452).—The magnetic anomalies previously reported extend to the thinnest Sn films and are not due to the presence of impurities or alloys. Below 10^{-5} cm. the depth of penetration of the field is dependent on the thickness of the film. D. F. R.

Movement of anisotropic liquids in a rotating magnetic field. V. ZVETKOV (Acta Physicochim. U.R.S.S., 1939, **10**, 555—578).—In a rotating magnetic field *p*-azoxyanisole is set in rotatory motion, and the torsional moments thereby communicated to the walls of the vessel have been measured. With increasing speed of rotation of the field the moment increases linearly to a max., and then decreases. The max. moment, and the frequency at which it occurs, $\propto H^2$. With rising temp. the max. becomes lower and shifts towards higher frequencies. The theory of the effect is worked out and the diamagnetic anisotropy is calc. in agreement with vals. obtained by other methods. F. J. G.

Magnetic measurements on hexaphenyldigermane. P. W. SELWOOD (J. Amer. Chem. Soc., 1939, **61**, 3168—3169).—Magnetic measurements have been made from −80° to 20° on powdered Ge_2Ph_6, and on a 0·00387M. solution of Ge_2Ph_6 in C_6H_6 at 25°, using the Gouy method. For the powdered samples $\chi = A + (C/T + \Delta)$, where $A = -0·47 \times 10^{-6}$, $C = 5·0 \times 10^{-3}$, and $\Delta = -150°$. A is considered to be the χ of undissociated Ge_2Ph_6, and the upper limit of dissociation is therefore 1%. In the solution, dissociation may occur to an extent $\not> 20\%$. W. R. A.

Magnetic properties of the compounds ethylcarbimide–ferrohæmoglobin and glyoxaline–ferrihæmoglobin. C. D. RUSSELL and L. PAULING (Proc. Nat. Acad. Sci., 1939, **25**, 517—522).—*EtNSC–ferrohæmoglobin* has two narrow absorption bands, 5540 and 5250 A. It is diamagnetic. The ratio NSC : Fe is 1 : 1. *Glyoxaline–ferrihæmoglobin* (I) has an absorption spectrum differing little from that of ferrihæmoglobin hydroxide. $\chi_{mol.}$ of (I) was obtained approx. by extrapolation and indicates the presence of one unpaired electron per hæmoglobin residue, with some orbital and spin moment. The bonds to Fe in (I) are of the octahedral covalent type. A. J. M.

Magnetic properties of intermediates in the reactions of hæmoglobin. C. D. CORYELL, L. PAULING, and R. W. DODSON (J. Physical Chem., 1939, **43**, 825—839).—The theory of the O-equilibrium of hæmoglobin (I) (Pauling, A., 1935, 878) is discussed, and the concns. of the intermediate compounds at various stages of the oxidation are deduced. Titrations involving the transformation of oxyhæmoglobin into ferrohæmoglobin (II) and of (II) into NO-hæmoglobin have been followed by magnetic susceptibility measurements. The observations disprove the theory that each Fe atom has 2 unpaired electrons, and support the view that the Fe atoms have each 4 unpaired electrons and are held in the (I) mol. by bonds which are essentially ionic in character. J. W. S.

Manganous compounds. (A) Antiferromagnetism. (B) Electrical conductivity as a function of temperature. C. F. SQUIRE (Physical Rev., 1939, [ii], **56**, 922—925, 960).—(A) The temp. dependence (300—40° K.) of the magnetic susceptibility χ of MnO, MnS, MnSe, and MnTe was measured. A λ-point transition at low temp. makes χ depart from a Weiss–Curie law and decrease with falling temp. Each compound has its characteristic transition temp., 116°, 140°, 247°, and 307° K., respectively, rising with increasing mol. wt. Evidence for field-dependence of χ and for magnetic hysteresis is found. An exchange force is probably the cause of the transition from paramagnetism to antiferromagnetism.

(B) MnSe, MnS, and MnO behave like non-conductors and show a regular decrease in resistance with rise of temp. Sp. conductivity increases with rising mol. wt. The temp.–resistance curve of MnTe is anomalous, rising to a max. at ~300° K. and then falling sharply. Causes of this anomaly are discussed. For each substance the magnetic hysteresis effect appears as an abnormally long relaxation time for the conductivity to return to its characteristic val. with change of temp. N. M. B.

Magnetism and molecular constitution of some manganese compounds. S. S. BHATNAGAR, B. PRAKASH, and J. C. MAHESHWARI (Proc. Indian Acad. Sci., 1939, **10**, **A**, 150—155).—Using a modified Gouy balance, the sp. susceptibility, χ, of the pink (I) and green (II) cryst. manganohalides of C_5H_5N (obtained by interaction of hydrated $MnCl_2$ and C_5H_5N in pure conc. HCl), K manganichloride (III), Ag permanganate (IV), and K manganicyanide (V), have been measured in the solid state. The experimental vals. of χ ($\times 10^6$) with theoretical vals. and probable formulæ in brackets are: (I) 55·80 [56·4, $MnCl_2,C_5H_5NHCl,H_2O$]; (II) 41·29 [40·84, $MnCl_4(C_5H_5NH)_2$]; (III) 18·05 [17·8, K_2MnCl_6]; (IV) 0·28 [~0, $AgMnO_4$]; (V) 4±1 [$K_5Mn(CN)_6$, impure]. W. R. A.

Refractive power of cellulose as a function of the degree of swelling. P. H. HERMANS and P. PLATZEK (Rec. trav. chim., 1939, **58**, 1001—1007).—In view of the possibility that the results of Meyer and Frey-Wyssling (A., 1936, 140) were due to working with natural anisotropic fibres, n_D^{20} for isotropic (viscose) fibres of varying H_2O content has been determined. For a moderate degree of swelling n

is $\gg$ calc. by either the linear or the quadratic mixture law, as found by Meyer and Frey-Wyssling, but for >40 wt.-% H_2O the anomaly almost disappears. Possible interpretations are discussed. F. J. G.

Atomic distances from optical refraction data. I. Simple relations between refraction, ionic radius, and atomic number. E. KORDES (Z. physikal. Chem., 1939, B, **44**, 249—260).—Empirical relations proposed by the author and by other investigators are critically reviewed. C. R. H.

Atomic refraction of sulphur from inorganic compounds (refractometric measurements). G. SPACŬ and E. POPPER (Z. physikal. Chem., 1939, **184**, 367—372).—Refractometric and *d* measurements on solutions at 22° give the following vals. of the mol. refraction: Na_2SO_4 14·927, Na_2SO_3 13·789, KHS 16·247, $Na_2S_2O_3$ 17·514, $Na_2S_4O_6$ 41·588. Using the vals. 1·525, 2·211, 3·17, and 5·295 for the at. refraction of O′, O″, Na, and K, respectively, the at. refraction of S in the above compounds is calc. to be 1·115, 2·188, 9·857, 4·106, and 10·56, respectively. O. J. W.

Relation between the number of carbon atoms, the refractive index, and the density of hydrocarbons. S. I. GOGOLASCHVILI (J. Gen. Chem. Russ., 1939, **9**, 1101—1103).—The no. of C atoms in hydrocarbons is given by $M(n_D d + 3{\cdot}001)/56{\cdot}35999 + 0{\cdot}0114M(n_D d - 1{\cdot}20552)$, where M is the mol. wt. R. T.

Dispersion curves of H_2 and D_2, H_2S and D_2S in the visible. O. E. FRIVOLD, O. HASSEL, and E. HETLAND (Physica, 1939, **6**, 972—976).—n and mol. refractions of H_2 and D_2 are recorded for λλ between 4046·6 and 6562·9 A. Vals. for $(n - 1) \times 10^6$ at these λλ are 142·32 and 140·62, and 138·54 and 136·55, for H_2 and D_2, respectively. n vals. for H_2S exceed those for D_2S by $\sim 3 \times 10^{-6}$ in the visible region. L. J. J.

New resonance positions in the absorption spectrum of thin metallic layers. H. WOLTER (Z. Physik, 1939, **113**, 547—553).—Theoretical. L. G. G.

Adiabatic piezo-optic coefficients of water and the alcohols. K. S. VENKATARAMAN (Proc. Indian Acad. Sci., 1939, **10**, A, 121—140).—The vals. of the adiabatic piezo-optic coeff., which defines the change of n of liquids due to adiabatic compression, have been measured by the method described previously (A., 1939, I, 453) for H_2O and seven alcohols, and the temp. coeffs. of n have been evaluated. The results are discussed with reference to the deviations from the Lorentz refraction formula, and the temp.-dependence of n at const. density. The elasto-optic coeffs. (I), calc. for pressure changes at const. temp. and at const. entropy, are > theoretical Lorentz vals. The effect of the anisotropy of the polarisation field, *i.e.*, the difference between the calc. val. of (I) at const. temp. and the theoretical val., in the alcohols is $\ll$ in CS_2 or C_6H_6. (I), calc. for temp. changes, approaches the Lorentz val. with increase in chain length in the alcohols. W. R. A.

Dynamo-optical properties of pure liquids and colloidal solutions. C. SADRON (Schweiz. Arch. angew. Wiss. Tech., 1937, **3**, 8—21; Chem. Zentr., 1937, i, 3111).—Data for double refraction due to flow in colloids disagree with Raman and Krishnan's theory, that of Boeder being a limiting case. The particle size can be approx. determined from the position of the principal axes and the val. of the double refraction. A. J. E. W.

Specific heat of a monatomic liquid. W. J. ARCHIBALD (Physical Rev., 1939, [ii], **56**, 926—932).—Mathematical. The partition function for an atom in a monat. liquid is evaluated by assuming that the atom is constrained by its nearest neighbours to move in a spherical region, and that the potential energy of the atom at any point within this region can be found if the law of force between two atoms is known. An expression for C_v is derived and results are compared with experimental vals. for liquid A. N. M. B.

Specific heat and double minimum problem of ammonia. R. F. HAUPT and E. TELLER (J. Chem. Physics, 1939, **7**, 925—927).—The discrepancy between experimental vals. for the sp. heat of NH_3 at 0—150° and vals. calc. using the Planck–Einstein formula for vibrational terms is 0·2—0·7%. A closer agreement is obtained by taking into account the anharmonicity of the 948 cm.$^{-1}$ vibration, due to its two potential min., and by making corrections for centrifugal stretching of the mol. and interaction between vibration and rotation. L. J. J.

Specific heat of ethyl ether, nitrobenzene, and carbon disulphide. J. MAZUR (Z. Physik, 1939, **113**, 710—720; cf. A., 1939, I, 189).—The temp.-dependence of the sp. heat for these liquids is measured over the approx. ranges 5—20° ($PhNO_2$), −120° to 20° (Et_2O), and −100° to 20° (CS_2), and for these substances respectively $c_p = 0{\cdot}338300 + 0{\cdot}000556\theta$, $0{\cdot}54239 + 0{\cdot}000595\theta$, and $0{\cdot}22674 + 0{\cdot}000773\theta + 0{\cdot}0000043\theta^2$. In the temp. ranges covered none of the liquids shows a transition point. L. G. G.

Determination of thermal properties of trifluorotrichloroethane [Freon 113]. L. RIEDEL (Z. ges. Kälte-Ind., 1938, **45**, 221—225).—The following data are given: d^0 1·6210±0·0003 g. per c.c., b.p. 47·68°, and m.p. −36·62±0·02°. The sp. vol. (c.c. per g.) is expressed by $v = 0{\cdot}6169(1 + 1{\cdot}390 \times 10^3\theta + 2{\cdot}74 \times 10^{-6}\theta^2 + 1{\cdot}22 \times 10^{-8}\theta^3)$, the v.p. (mm. Hg) by $\log p = 12{\cdot}5508 - 2099/T - 1{\cdot}3505 \times 10^{-2}T + 0{\cdot}1171 \times 10^{-4}T^2$, the heat of evaporation (g.-cal. per g.) $= 37{\cdot}90 - 6{\cdot}75\theta \times 10^{-2} - 0{\cdot}7\theta^2 \times 10^{-4}$, and the sp. heat (g.-cal. per g.) by $c_p = 0{\cdot}2172 + 0{\cdot}031\theta \times 10^{-2} + 0{\cdot}012\theta^2 \times 10^{-4}$. The P–V–T relation of the gas was determined from 21·23° to 85·69°. R. B. C.

Molecular structure of aliphatic compounds and their boiling points. E. NEYMAN-PILAT (J. Amer. Chem. Soc., 1939, **61**, 3235—3236).—Polemical against Kinney (A., 1939, I, 134). W. R. A.

Calculation of the b.p. numbers of aliphatic compounds. C. R. KINNEY (J. Amer. Chem. Soc., 1939, **61**, 3236—3237).—A reply to Neyman-Pilat (cf. preceding abstract). W. R. A.

Theory of enveloping electrons. J. ZERNIKE (Chem. Weekblad, 1939, **36**, 748—750).—On the basis of van Laar's theory of the additivity of $\sqrt{a}$ (van der Waals), it is shown that the influence

of enveloping electrons on b.p. is $\not>100°$; hence Kossel's explanation of the large fall in b.p. between the fluorides and chlorides of certain metals is incorrect; it fails to explain why no similar fall in b.p. occurs between chlorides and iodides or between hydrides and methides. Elements with high-boiling fluorides and low-boiling chlorides form bases and complex fluorides, which are to be regarded as autocomplex salts. The anomalous case of Hg is discussed. S. C.

Fusion process in argon. O. K. Rice (J. Chem. Physics, 1939, **7**, 883—892).—Theoretical. The view of fusion as an order–disorder phenomenon is discussed in relation to the variation of the thermodynamic functions $(\partial E/\partial V)_T$ and $(\partial S/\partial V)_T$ with the molal vol. These relations are shown to be consistent with Bridgman's P–V–T data for A. L. J. J.

Crystallisation of water. II. W. Altberg and V. Lavrov (Acta Physicochim. U.R.S.S., 1939, **11**, 287—290; cf. A., 1938, I, 609).—In H_2O supercooled 1—4° crystallisation can be initiated, without the introduction of extraneous nuclei, through mechanical stimulation by tapping, rubbing, stirring, or by ultrasonic waves. F. L. U.

Heterophase fluctuations and pretransition phenomena. J. Brody (J. Chem. Physics, 1939, **7**, 972).—A claim of priority against Frenkel (cf. A., 1939, I, 454). L. J. J.

Molecular-statistical theory of melting. S. Bresler (Acta Physicochim. U.R.S.S., 1939, **10**, 491—512).—A measure of degree of orderliness which is applicable to both liquid and solid states is the probability (S) of a distribution with the same no. of neighbours m as in the ideal lattice. It is shown that for the simple case of spherically symmetrical mols. exerting only van der Waals forces, $S = (1 + e^{-v/kT})^{-m}$, where v is the energy barrier protecting the ordered state (co-ordination no. m). It is further assumed that v is a linear function of S. True states of the system are then represented by intersections of the curves $S(v)$ and $v(S)$. At low and at high temp. there is only one intersection, with vals. of S corresponding respectively with a high and a low degree of order, whereas at intermediate temp. there are three intersections, the middle one representing an unstable state. In this way a qual. description of melting, freezing, and supercooling is obtained, and it is implied that superheating of the crystal should also be possible. An expression for the free energy in terms of S is given, and the kinetics of crystallisation are discussed. F. J. G.

Statistical mechanics of condensing systems. VI. Treatment of a system of constant energy. S. F. Streeter and J. E. Mayer (J. Chem. Physics, 1939, **7**, 1025—1038; cf. A., 1939, I, 128).—Mathematical. Equations for the thermodynamic functions of an imperfect gas up to and including the condensation pressure are calc. for a one-component system consisting of chemically saturated mols. W. R. A.

Phase transitions. J. E. Mayer and S. F. Streeter (J. Chem. Physics, 1939, **7**, 1019—1025).—H–T and V–P curves for different types of phase transitions are discussed. For a second-order transition a discontinuity in the curvature of the free energy curve is observed, indicating some change in the system in the phase of high C_p. When the change is complete C_p falls abruptly to a lower val. and an extrapolation of the phase is meaningless. The experimental difficulties in distinguishing an anomalous first-order transition are emphasised. This type of transition, where C_p and compressibility approach infinity continuously as the transition is approached, can be distinguished by sound velocity or density measurements. A positive surface free energy between the phases necessitates a simple first-order transition. W. R. A.

Summation of state, degree of dissociation, and degree of ionisation of gases. K. H. Riewe (Z. physikal. Chem., 1939, **184**, 393—398).—Formulæ are derived by means of statistical mechanics. O. J. W.

Partial and total emissive power of some substances. Generalised Wien law. III. A. Carrelli (R. C. Atti Accad. Lincei, 1939, [vi], **29**, 435—441).—The generalised Wien law holds for Pt, graphite, Ni_2O_3, and Co_2O_3. λλ of max. emissive power at different temp. are recorded. (Cf. A., 1939, I, 557.) O. J. W.

Emissive and thermionic characteristics of uranium. W. L. Hole and R. W. Wright (Physical Rev., 1939, [ii], **56**, 785—787; cf. A., 1938, I, 352).—The following vals. for clean U in vac. were found: emissivity below the m.p. ($\lambda = 0{\cdot}67\ \mu$.), 0·51; thermionic work function, $3{\cdot}27 \pm 0{\cdot}05$ v., with a Richardson A of ~ 6; m.p., $1700 \pm 25°$; average coeff. of linear expansion, 25—1000°, 4×10^{-5}. N. M. B.

Additivity of molecular volumes. N. F. Komschilov (J. Gen. Chem. Russ., 1939, **9**, 701—707).—The mol. vol. of org. compounds may be calc. as the sum of the vols. of their constituent elements. R. T.

Raoult's law and the Clapeyron equation for substances whose vapours are polymerised. J. H. Simons and A. S. Russell (J. Physical Chem., 1939, **43**, 901—907).—A theoretical explanation is given for the observation that for substances such as AcOH and HF a plot of log p against $1/T$ (p = v.p., T = temp. °K.) yields a relatively straight line. Raoult's law is shown to be independent of the nature of the liquid and to depend only on the apparent mol. wt. of the vapour. J. W. S.

Saturated vapour pressure of lithium between 462° and 642°. (Mlle.) M. Maucherat (J. Phys. Radium, 1939, [vii], **10**, 441—444).—A detailed account of work already noted (A., 1939, I, 190). W. R. A.

Vapour-pressure formula for high temperatures. H. Scheffers (Z. physikal. Chem., 1939, **B**, **44**, 53—56).—Introduction of the Debye limiting frequency ($\nu_s = k\theta/h$) into the Stern v.p. formula gives an expression for the v.p. of a monat. solid which leads to the evaluation of θ from v.p. data. From published data, θ for Ag = 219°. F. J. G.

Vapour pressures of ortho- and para-hydrogen and ortho- and para-deuterium. K. Cohen and

H. C. UREY (J. Chem. Physics, 1939, **7**, 1068).—A correction (cf. A., 1939, I, 410). W. R. A.

Equation of state of real gases. M. P. VUKALOVITSCH and I. I. NOVIKOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 768—773).—The equation of state of a real gas is deduced on the basis of the Clapeyron equation and of a mass action equilibrium between single and associated mols. A. J. M.

Theory of metallic state. I. V. V. TARASOV and B. P. BERING (J. Phys. Chem. Russ., 1939, **13**, 124—132).—An equation of state for metals is given. It contains two unknown vals., namely the no. n of "free" electrons per atom and the vol. available for these electrons, which can be calc. from thermal expansion and compressibility. For most metals $n = 1$, but for some $n = 2$. J. J. B.

Hole theory of condensation. J. G. KIRKWOOD (J. Chem. Physics, 1939, **7**, 908—911).—The failure of Cernuschi and Eyring's theory (A., 1939, I, 461) to take full account of the lattice vibrational factor in the partition function leads to crit. solution temp. several times > experimental vals. for non-polar fluids. L. J. J.

Dissociation treatment of condensing systems. II. W. BAND (J. Chem. Physics, 1939, **7**, 927—931; cf. A., 1939, I, 358).—The theory presented in the previous paper is developed by taking into account excluded vols., and gas and vapour isothermals right through the crit. temp. are deduced. L. J. J.

Partition functions for partly classical systems. E. B. WILSON, jun. (J. Chem. Physics, 1939, **7**, 948—950).—Mathematical. L. J. J.

Change of thermal conductivity of bismuth single crystals due to magnetic field. T. HIRONE and S. MATUDA (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 711—720).—According to Jones' interpretation of the electronic structure of Bi, the change of thermal conductivity due to a magnetic field (H) is $\propto H^2$. Calculations for three cases in which the thermal current and magnetic field are perpendicular to each other, and parallel or perpendicular to the principal axis of the crystal, give results of the same order of magnitude as experimental data. L. J. J.

Intermolecular forces and viscosity of liquids. H. HARMS (Z. physikal. Chem., 1939, **B**, **44**, 14—40).—Theoretical. The relationship between viscosity and constitution is discussed and exemplified by reference to a large no. of org. liquids. The mol. viscosity function used is $\eta_M = \eta V_M^{1/3}$. The effects of orientation, induction, and dispersion forces are considered, and also the effects of steric screening of polar groups. In liquids η involves both transference of energy, as in gases, and conduction of impulses through mols. closely linked in association complexes. Accordingly, in contrast to the views of Kyropoulos (A., 1939, I, 135), association will in general mean an increase of η, since the conduction of impulses through the complexes will outweigh the effect of the diminution of residual force fields between them. F. J. G.

Relations between viscosity and elasticity of amorphous substances. A. SMEKAL (Z. physikal. Chem., 1939, **B**, **44**, 286—298).—Theories of elasticity and η in so far as they concern the mechanism of the solidification of melts are reviewed. The Maxwell relation between elasticity, η, and relaxation time is satisfied by data for six glasses over the solidification range, although for long relaxation times the agreement is not so good. C. R. H.

Velocity of fall of liquid drops in melts. M. P. VOLAROVITSCH and A. A. LEONTEEVA (Acta Physicochim. U.R.S.S., 1939, **11**, 251—256).—The rate of fall of drops of Pb in liquid B_2O_3 is given within 5—10% by Hadamard and Rybczynski's modification of Stokes' formula (cf. Bond, Phil. Mag., 1927, [vii], **4**, 898). The fall of metal drops in slags and the rise of slag through molten metals are discussed. F. L. U.

Flow of gases through metallic capillaries at low pressures. H. ADZUMI (Bull. Chem. Soc. Japan, 1939, **14**, 343—347; cf. A., 1937, I, 458).—The curves for the rate of flow of gases through metallic capillaries as a function of pressure have the same general form as for glass capillaries, but the vals. of γ in the expression: rate of flow = const. $\times\, pr^4/\eta l$ + const. $\times\, \gamma(r^3/l)\sqrt{(T/M)}$ depend on the material of the tube. In a theoretical analysis in which adsorption is taken into account the expression $\gamma = \{1 - \beta(1 - e^{-cp})\}/\{1 + \beta(1 - e^{-cp})\}$ is deduced, where β is the fraction of mols. reflected (not adsorbed) on collision, and c is a proportionality const. Vals. of β and c for H_2 in Ag, Al, Cu, and Fe are given. F. J. G.

History of the statistical-kinetic theory of rubber-like elasticity. E. WÖHLISCH (Z. physikal. Chem., 1939, **184**, 416—418).—Regarding priority. O. J. W.

Transport phenomena in mixtures of gases. E. J. HELLUND and E. A. UEHLING (Physical Rev., 1939, [ii], **56**, 818—835).—Mathematical. The Lorentz–Hilbert–Enskog method, taking full account of quantum statistics, and previously used for a single-component gas (cf. A., 1933, 551; 1935, 157), is extended to mixtures of gases. Expressions for η, heat conductivity, pressure diffusion, and thermal diffusion coeffs. are obtained. N. M. B.

Pressure of the saturated vapour of two volatile liquids miscible in all proportions. N. D. LITVINOV (J. Phys. Chem. Russ., 1939, **13**, 119—123).—From the equation of Duhem and Margules a formula is deduced which allows the partial v.p. to be calc. if the total v.p. of two mixtures and the v.p. of the pure components are known. J. J. B.

Vapour–liquid equilibrium. IV. Carbon tetrachloride–*cyclo*hexane mixtures. G. SCATCHARD, S. E. WOOD, and J. M. MOCHEL (J. Amer. Chem. Soc., 1939, **61**, 3206—3210).—The v.p.–concn. curves of the system CCl_4–*cyclo*hexane at 40° and 70°, together with the v.p. at 30°, 50°, and 60° of approx. equimol. mixtures and the ρ of mixtures at 25°, have been determined. Equations are derived for the thermodynamic functions including the energy and entropy of mixing at const. total vol. The v.p.–composition curves are of the simple type and the relatively large deviation from regularity is explained by the vol.

change on mixing. The entropy increase on mixing is $\frac{1}{13}$ of that found for C_6H_6–*cyclo*hexane mixtures. W. R. A.

Viscosity of system B_2O_3–SiO_2 and calculation of activation energy for vitreous systems. A. LEONTEEVA (Acta Physicochim., U.R.S.S., 1939, **11**, 257—264).—Measurements of η at 530°, 630°, and 800° are recorded for mixtures containing up to 22% of SiO_2. For 5% of SiO_2 the activation energy increases with rise of temp., in contrast to the behaviour of normal liquids; this effect is attributed to strong interaction between ions produced by increased dissociation of the mols. at higher temp. Above 10% of SiO_2 the glasses behave like normal structural liquids. F. L. U.

Osmotic pressure. H. FRAHM (Z. physikal. Chem., 1939, **184**, 399—410).—Theoretical. The laws of the relative v.p. lowering and of the osmotic pressure of solutions are derived from the Maxwell–Boltzmann energy partition law. The limiting laws of Raoult and van 't Hoff depend on the thermal energy exchange between solute and solvent mols., whereas the deviations from these laws are brought about by sp. mol. forces. O. J. W.

Variation of the differential diffusion constant of hydrochloric acid with temperature. W. A. JAMES and A. R. GORDON (J. Chem. Physics, 1939, **7**, 963—965).—The data already recorded (A., 1939, I, 192) are extended by measurements at 10—35° for 0—1·0N-HCl. The activation energy of diffusion is independent of concn. up to 0·2N., and decreases with increasing temp. At higher concns., it increases with the concn. L. J. J.

Anomalous diffusion of [benzo]quinone in salt solutions. H. FREUNDLICH and D. KRÜGER (J. Physical Chem., 1939, **43** 981—988).—The diffusion experiments previously described (cf. A., 1935, 928) have been extended, and the diffusion of KCl, K_2SO_4, or NaCl into solutions of benzoquinone (I) or $(CH_2{\cdot}CO_2H)_2$ (II) has been investigated. There is a decrease or increase of concn. of (I) or (II) on the salt side and an increase or decrease on the H_2O side according to whether the solubility of the org. solute is decreased or increased in presence of the salt. C. R. H.

Viscosity relationships of aqueous solutions of sodium oleate and various phenols. R. G. D. MOORE (J. Amer. Chem. Soc., 1939, **61**, 2990—2995). —η of ternary systems of Na oleate–H_2O–a phenol have been measured. With PhOH, guaiacol, *p*-cresol, and creosol pronounced max. are observed in the η–concn. curves. The effects with *o*- and *m*-$C_6H_4(OH)_2$ and *o*-$C_6H_4Br{\cdot}OH$ are not so marked. Vanillyl alcohol, *p*-$OH{\cdot}C_6H_4{\cdot}CH_2{\cdot}OH$, vanillin, and *p*-$OH{\cdot}C_6H_4{\cdot}CHO$ do not increase η of the Na oleate solutions. The effect appears to vary inversely as the acidity of the phenols, in contrast to the theory of Weichherz and Saechtling (A., 1932, I, 994) that the formation of acid soaps is a contributory cause of the observed max. W. R. A.

Periodic sedimentation from solutions during evaporation of the solvent. N. F. JERMOLENKO and S. LEVINA (J. Gen. Chem. Russ., 1939, **9**, 965—970).—Periodic sedimentation is obtained with any inorg. salt (16 were tested) if its 0·0002N. solution is evaporated at 85° on a watch glass, and with any org. acid (11 were tested) if its aq. solution is evaporated at 15°/3 mm. in a narrow tube. $NiSO_4,7H_2O$ and BzOH give the highest, and $Na_2S,9H_2O$ and malic acid the lowest no. of rings. These observations agree with the theory (cf. A., 1938, I, 307). J. J. B.

Hole theory of diffusion. R. P. JOHNSON (Physical Rev., 1939, [ii], **56**, 814—818; cf. Steigman, A., 1939, I, 505).—A co-ordination of mechanism and mathematical considerations on energy. N. M. B.

Diffusion of gases through metals. J. H. SIMONS and W. R. HAM (J. Chem. Physics, 1939, **7**, 899—902).—Theoretical. The usual laws of diffusion, including Fick's linear law, are shown to be consistent with the hypothesis of chemical equilibrium between metal and gas and metal–gas compounds. A no. of possible cases are considered. L. J. J.

Diffusion of hydrogen through oxygen-free copper. W. R. HAM (J. Chem. Physics, 1939, **7**, 903—907).—The rate of diffusion of H_2 through spectroscopically O-, Ni-, and Fe-free Cu at 450—1050° is $\propto p^yT^ze^{-b/T}$, where $y = 0{\cdot}50 \pm 0{\cdot}01$, $z = 0{\cdot}5 \pm 0{\cdot}2$, and b is a const. The presence of small amounts of O increases y, except at high temp. L. J. J.

Diffusion of oxygen in copper. C. E. RANSLEY (J. Inst. Metals, 1939, **65**, Advance copy, 537—561). —The evolution of O_2 from Cu is negligible at temp. at which the Cu is not appreciably volatile; at higher temp. small amounts of O are lost, probably as Cu_2O. When Cu containing Cu_2O is heated in pure CO the O is removed by a surface reaction. Since CO does not diffuse into solid Cu, the rate of O removal is dependent on the rate of diffusion of O to the surface and is not affected by the CO pressure. From measurements made on two specimens of Cu with different O contents it is shown that the diffusivity const. of O in Cu is $1{\cdot}1 \times 10^{-9}$ sq. cm. per sec. at 600° and $2{\cdot}1 \times 10^{-6}$ sq. cm. per sec. at 950°, corresponding with an activation energy of 46 kg.-cal. per g.-atom. Embrittlement of Cu in a reducing atm. at high temp. is due to H penetration, reaction of which with the O takes place at grain boundaries (to which the O is constantly diffusing) and thus produces fissures into which H_2 can penetrate and cause rapid deoxidation. Cu can be completely deoxidised without embrittlement by prolonged heating at >800° in CO free from traces of H_2; a similar result is obtained in H_2 only when the pressure is $\not>$2 mm. A. R. P.

Temperature-dependence of the diffusion constants of atomic hydrogen and protons in iron. A. GÜNTHER-SCHULZE and H. BETZ (Z. Physik, 1939, **114**, 82—91).—The temp. coeff., D_a, of the diffusion const. for H, determined by an electrolytic method, is given by the equation $\log D_a = 0{\cdot}0193T - 5{\cdot}66$. The temp. coeff. for protons between 22° and −66° is negligible. L. G. G.

Influence of microstructure on process of diffusion in solid metals. F. N. RHINES and C. WELLS (Trans. Amer. Soc. Met., 1939, **27**, 625—665).—Studies of structural changes accompanying

diffusion, anisotropy of diffusion, and intergranular diffusion were made, using published and new data. Columnar grains form in systems involving a phase change. Recrystallisation, grain growth, and twinning may be induced in a single phase by diffusion if the sp. vol. changes caused by a movement of solute are sufficiently large. New evidence of anisotropy of diffusion in cubic metals (Cu–Zn system) is given, and it is shown that anisotropy may depend on the concn. of the solute. Intergranular diffusion in metal systems seems to be faster than intragranular diffusion. C does not diffuse faster through γ-Fe grains than along boundaries. R. B. C.

Thermal expansion [of alloys] at low temperatures.—See B., 1939, 1251.

Curie constants and Curie temperatures of nickel alloys. K. F. NIESSEN (Physica, 1939, 6, 1011—1033).—A discussion of Slater's theory for Ni–Cu and Ni–Zn alloys. L. J. J.

Plasticity of polycrystalline solid solutions of metals. J. B. FRIEDMANN (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 683—685).—The influence of composition on the plasticity of polycryst. solid solutions is discussed, the reduction of the area being chosen in preference to the relative elongation for estimating the max. plasticity. Pure solid solutions with Ni, Cu, Ag, Al, and other face-centred metals as a basis do not show cold-brittleness but the plasticity decreases with increase in concn. Anomalies in the system Cu–Zn and Cu–Sn are explained by the marked effect of impurities (*e.g.*, O_2) on the plasticity of Cu. Pure solid solutions with Fe or Mg as a basis exhibit cold-brittleness but the plasticity increases with concn. in the temp. region of cold-brittleness, the temp. interval of the plastic state also widening. At high temp. the plasticity decreases with increase in concn. W. R. A.

Heats of formation and states of order in the system gold–copper. F. WEIBKE and U. F. QUADT (Z. Elektrochem., 1939, 45, 715—727).—The variation of e.m.f. (E) with temp. has been determined for Au–Cu alloys containing 14·8—95% of Cu, using a Cu reference electrode and electrolytes consisting of LiCl–KCl or LiCl–RbCl eutectic containing CuCl. At 500° E falls steadily with increasing [Cu], showing statistical distribution of atoms in the lattice, but below 425° discontinuities in the curve indicate the existence of the intermediate phases AuCu, Au_2Cu_3, and $AuCu_3$; the dE/dT variations give degrees of disorder at 370° of 0·5, 4, and 0·4% respectively. The Gibbs–Helmholtz equation gives 1·25 kg.-cal. per g.-atom of alloy (55 at.-% Cu) as the max. heat of formation of the mixed crystals, and the heat liberated on formation of the above phases from the disordered mixed crystals is 0·38, 0·14, and 0·37 kg.-cal. per g.-atom, respectively. A. J. E. W.

Change of heat of activation of the phase AuCu during the order–disorder transition. A. SCHNEIDER (Z. Elektrochem., 1939, 45, 727—731).—The variation with the annealing temp. (θ) of the heat of activation (q) of an Au–Cu alloy (49·7 at.-% Au) in the catalytic decomp. of HCO_2H is studied. After quenching from 500° two metastable intermediate states ($\theta = 250$—300°, 385—415°) occur during formation of an ordered lattice. In these states, which are characterised by Debye–Scherrer photographs, the catalyst has q vals. 8 and 5 kg.-cal. > that for the ordered or completely disordered state. The peaks in the q–θ curve correspond with anomalies in the elasticity modulus of the alloy. A. J. E. W.

Thermodynamic study of the zinc–antimony system. Thermodynamic properties of the intermetallic compounds ZnSb, Zn_3Sb_2, and Zn_4Sb_3. B. DEWITT and H. SELTZ (J. Amer. Chem. Soc., 1939, 61, 3170—3173).—By measuring the e.m.f. of cells of the type Zn (l)|$ZnCl_2$ in LiCl + KCl (l)|Zn (in Zn–Sb liquid solutions) the activities and partial mol. relative heat contents of Zn and Sb in their liquid solutions have been determined. Vals. are given for the solid solubility of Zn in Sb and for the free energies, heats of formation, and entropies of ZnSb, Zn_3Sb_2, and Zn_4Sb_3. The heat of fusion of Zn_3Sb_2 is 12,190 g.-cal. W. R. A.

Thermal study of Al–Ag alloys in the region of the β-phase. F. E. TISCHTSCHENKO (J. Gen. Chem. Russ., 1939, 9, 729—731).—The phase diagram given by Hoar and Rowntree (A., 1931, 556) is confirmed. Transformation of the β-phase at 456°, with formation of $AlAg_3$, is observed. R. T.

Alloys of gallium and indium. F. WEIBKE (Z. Metallk., 1939, 31, 228—230).—Structural analogies in the binary systems of Cu and Au with Ga, In, Al, and Sn are pointed out. Addition of Ni to In–Cu alloys promotes pptn.-hardening with lower In contents. A. R. P.

Constitution of dilute alloys of lead with sulphur, selenium, and tellurium. J. N. GREENWOOD and H. W. WORNER (J. Inst. Metals, 1939, 65, Advance copy, 513—523).—The solubility of S, Se, and Te in Pb at 300° and the eutectic compositions were determined by micro-examination and by electrical resistivity measurements. The results indicate that Pb dissolves at 300° <0·0001% S, ~0·0015% Se, and 0·004% Te. The eutectics contain <0·0001% S, 0·005% Se, and 0·025% Te, respectively; the Se eutectic melts at 0·2° and the Te eutectic at 0·7° below the m.p. of Pb. Se in solid solution slightly decreases, whilst Te increases, the resistivity of Pb. A. R. P.

Magnetic test for superstructure in permalloy. S. T. PAN (Physical Rev., 1939, [ii], 56, 933—936; cf. McKeehan, A., 1939, I, 247).—A search for indirect evidence of superstructures $FeNi_3$ and Fe_2Ni_2 by investigating changes of saturation magnetisation with annealing and heat-treatment is described. Results support ordering processes in the ranges 640—400° and 800—400°, respectively, and agree with available data. N. M. B.

Alloys of magnesium. IX. Constitution of the magnesium-rich alloys of magnesium, aluminium, and silver. J. L. HAUGHTON (J. Inst. Metals, 1939, 65, Advance copy, 563—572).—The Al–Ag–Mg system has been examined by thermal and micrographic methods from the Mg corner up to 40% Al and 50% Ag. The ternary eutectic is at

403°±1°, Al 19, Ag 28·2, Mg 52·8%. The Al–Mg solid solution dissolves a max. of 5·2% of Ag, dissolution of which does not affect the solubility of Ag in Mg. The Ag–Mg solid solution dissolves a max. of 8·8% of Al, but this Al greatly depresses the amount of Ag retained in solution. Contour plans of the liquidus, secondary separation, solidus, and solid-solubility surfaces, and a no. of vertical sections through the constitution prism in the vicinity of the eutectic limits are given. A. R. P.

Copper-rich nickel–aluminium–copper alloys. III. Effect of heat-treatment on microstructure. W. O. ALEXANDER (J. Inst. Metals, 1939, **65**, Advance copy, 499—512; cf. A., 1939, I, 314).—In the hardening heat-treatment of Cu or brass containing Ni and Al the compound Ni_3Al (θ) or NiAl is pptd.; within a narrow composition range both are pptd. The form in which these pptns. occur varies with the heat-treatment given. Alloys of Cu with Ni and Al in the ratio 1 : 1 or brasses with 10—30% Zn and Ni and Al in the ratio 1—4 : 1 harden by pptn. of NiAl, whereas Cu alloys with a 4 : 1 Ni–Al ratio harden by pptn. of θ. Ordinary quenching (from 900°) and tempering (at 500°) treatments result in the development of a stable, recryst. "ragged" α-matrix containing finely-dispersed θ, whereas slow cooling from 700° to 600° (3 days) produces lamellar α + θ eutectoid in a recryst. α-matrix, and very slow cooling (10 days) between the same temp. range results in a trefoil ppt. of θ in a recryst. α-matrix. A. R. P.

Constitution diagrams for iron–carbon–molybdenum alloys. J. R. BLANCHARD, R. M. PARKE, and A. J. HERZIG (Trans. Amer. Soc. Met., 1939, **27**, 697—717).—From observations made by microscopic examination and hardness tests on 41 alloys 12 constitutional diagrams of the Fe–C–Mo system up to 1·2% C and 6% Mo were constructed. The diagrams show the structures found in the alloys when quenched in H_2O from various temp. between 732° and 1010° and when normalised from the same temp. Structurally the primary effect of Mo appears to be to restrict austenite grain growth. It strongly retards the transformation of austenite, thereby inducing high hardenability. The occurrence of the ω-phase in Mo steels containing >1·5% of Mo was established. R. B. C.

Solubility of sodium chloride in mixtures of protium and deuterium oxide. T. L. CHANG and T. C. CHU (Z. physikal. Chem., 1939, **184**, 411—415).—The solubility of NaCl (s_n) in various H_2O–D_2O mixtures at 25° is given with an accuracy of ±0·1% by $s_n = 6{\cdot}145—0{\cdot}334n$, where s_n = no. of mols. of NaCl dissolved in 55·51 mols. of a H_2O–D_2O mixture in which the mol. fraction of D_2O is n. O. J. W.

Chemical properties of acetates. Solubility of sulphanilic acid in acetic acid in presence of acetates. A. I. TITOV (J. Gen. Chem. Russ., 1939, **9**, 932—935).—The solubility of sulphanilic acid in AcOH at 100°, in presence of Li, Na, or K acetate, is given by $S = K_1C + K_2C^3$, where K_1 and K_2 are consts., and C is the effective concn. of acetate. R. T.

Cation exchange in cellulosic materials.—See B., 1939, 1222.

Adsorption of a gas accompanied by its dissociation. O. I. LEIPUNSKI (Acta Physicochim. U.R.S.S., 1939, **10**, 529—538).—Theoretical. An analysis taking account of dissociation and recombination on the surface is given, and the isotherms for the atoms are shown to be of the same types as for activated adsorption. With 11,000 g.-cal. for the heat of dissociation of H_2 on Ni the experimental adsorpton isotherms of H_2 on Ni can be reproduced. An expression for the "clean-up" of H on W in agreement with observation is deduced. F. J. G.

Adsorption of helium gas on active charcoal between 4·22° K. and 1·78° K. A. VAN ITTERBEEK, W. VAN DINGENEN, and J. BORGHS (Physica, 1939, **6**, 951—960).—Adsorption isotherms of the form given by Williams' theory have been obtained. Heats of adsorption calc. from the isotherms have a min. val. of ~22 g.-cal. per mol. at the λ point. The adsorption velocity at this point also passes through a min., which at certain pressures takes the form of a discontinuity, the adsorption increasing again at a lower temp. L. J. J.

Calorimetric investigations of the physical and activated adsorption of hydrogen on nickel. A. EUCKEN and W. HUNSMANN (Z. physikal. Chem., 1939, **B**, **44**, 163—184).—The two types of adsorption of H_2 on Ni have been investigated calorimetrically and by a desorption method at 20—273° K. Two types of adsorption centre appear to exist, for which the heats of activation of the adsorption process are 9—10 and 18—22 kg.-cal. per g.-mol., respectively. The first type comprises 14% of the total adsorption spots. The heat of adsorption increases almost linearly from 4 to 21 kg.-cal. per g.-mol. as the adsorption centres become covered. The heat change associated with physical (van der Waals force) adsorption is ~0·8 kg.-cal. per g.-mol., but varies considerably with the extent to which the surface is covered. J. W. S.

Sorption of hydrogen by metals of the platinum group. I. Sorption isotherms of the systems iridium–, rhodium–, osmium–, and ruthenium–hydrogen. II. Effect of thermal treatment of [iridium- and rhodium-]black on its sorptive power. P. I. BELKEVITSCH (J. Gen. Chem. Russ., 1939, **9**, 944—954, 955—958).—I. The sorption isotherms (20° and 50°) are of the same type for Ir-, Rh-, Os-, and Ru-black as for Pt-black.

II. Sorptive capacity falls linearly with rising temp. and with increasing duration of heating of Ir- and Rh-black, at 150—400°. R. T.

Activated adsorption of gases by heteropolar crystals. C. F. TOMPKINS (J. S. African Chem. Inst., 1939, **22**, 37—43).—The slow absorption of gases by cryst. surfaces is attributed to penetration of the gases into the Smekal cracks. It is supposed that normally the gas mols. cannot pass between the mols. which are adsorbed immediately along the edges of the cracks, and that they can enter the cracks only when the combined amplitudes of vibration of adjacent adsorbed mols. are great enough to furnish temporarily a gap wide enough to permit passage of a gas mol. In the adsorption of NH_3 on NaCl the theoretical val. of the energy required for this process

is in approx. accord with the observed val. of the heat of activation of the slow absorption process (cf. Trans. Faraday Soc., 1934, **34**, 1, 469). J. W. S.

Absorption of carbon dioxide by solid sodium carbonate. J. I. ZILBERMAN, P. T. IVANOV, and K. P. MISCHTSCHENKO (J. Appl. Chem. Russ., 1939, **12**, 986—995).—Saturated aq. $NaHCO_3$ is added to Na_2CO_3, in amount sufficient to give a ratio of 3—5 mols. of H_2O per mol. of Na_2CO_3, and 13—39% CO_2 is passed through the mass at 18—25°. In these conditions CO_2 is rapidly absorbed, to yield pure $NaHCO_3$. Freshly prepared Na_2CO_3 is a more active absorbent than are samples which have undergone storage. R. T.

Sorption of oxygen by active carbon, determined by magnetic measurements. R. JUZA and R. LANGHEIM (Z. Elektrochem., 1939, **45**, 689—698).—The sorption of O_2 by sugar-C activated by treatment with H_2O and Cl_2 at 950° is studied. At 18° the amount adsorbed in the mol. form decreases on keeping, and after 40 hr. no mol. O_2 is adsorbed until 3 c.c. per kg. of C are combined as surface oxides. With higher O contents the proportion of mol. O_2 rises and further formation of oxides is small. The amount of combined O increases rapidly with rising temp. (18—200°). After 10 hr. surface oxide formation is a zero-order reaction (energy of activation ~5 kg.-cal.), showing that the reaction occurs with adsorbed mols. A new magnetic balance is used to study χ for adsorbed O at −183°; as the O content increases χ falls steadily from the val. for gaseous O_2 to that for the liquid. This may be due to closer packing or to association to O_4 mols. A. J. E. W.

Structure of the adsorption layer and the adhesion of microscopic particles. A. VON BUZÁGH (J. Physical Chem., 1939, **43**, 1003—1014).—A general summary (cf. A., 1939, I, 73). C. R. H.

Equivalent adsorption of anions and cations. (MLLE.) L. DE BROUCKÈRE (Bull. Soc. chim. Belg., 1939, **48**, 326—328; cf. A., 1933, 457).—$BaSO_4$ pptd. with excess of $Ba^{\cdot\cdot}$ adsorbs more Cl′ than $Cu^{\cdot\cdot}$ from a solution of $CuCl_2$, whilst when pptd. with excess of SO_4'' it adsorbs more $Cu^{\cdot\cdot}$ than Cl′. In each case the difference decreases with repeated preliminary washing, and after 40 such washings the ratio of adsorbed $Cu^{\cdot\cdot}$ and Cl′ = 1. F. L. U.

Lyotropic series and adsorption. A. R. DOCKING (J. Proc. Austral. Chem. Inst., 1939, **6**, 400—406).—Similar results are obtained for the adsorption of salts by methylcellulose and the solubility of the latter in salt solutions as were previously obtained with isoelectric gelatin (A., 1939, I, 320). An explanation based on hydration of the ions is offered. F. L. U.

Catalytic activity of enzymes on organic adsorbents. B. A. TALMUD and D. L. TALMUD (Acta Physicochim. U.R.S.S., 1939, **10**, 481—490).—The catalytic activity for the $Br-C_2H_4$ reaction of "inverted" palmitic acid (I) (*i.e.*, having the CO_2H groups directed outwards) is > that of the non-inverted acid. Pepsin (II) and urease (III) are strongly adsorbed on inverted (I), (II) retaining all, and (III) two thirds, of its initial activity. On non-inverted (I), (II) is not adsorbed, and (III) is adsorbed but loses its activity. (II) is not adsorbed on inverted cetylamine but the solution loses its activity. F. J. G.

Absorption studies on enamel, dentine, and bone.—See A., 1939, III, 1095.

Capillary activity of hydrophilic colloids. K. F. SHIGATSCH and P. A. REHBINDER (J. Phys. Chem. Russ., 1939, **13**, 94—105).—The surface tension γ of aq. solutions of ovalbumin, saponin, and tragacanth slowly decreases and at 20° reaches a const. val. within 30, 15, 20 min., respectively. This const. val. for gelatin solutions is reached the earlier the lower is the concn. Starch and agar do not lower the γ of H_2O. They readily give gels whilst capillary-active substances do not gelate. J. J. B.

Surface and interfacial tensions of solutions of cyanines. M. AUBRY (J. Chim. phys., 1939, **36**, 263—270).—The surface tension of methyl-2 : 2-diethylthiocarbocyanine bromide in aq. solution decreases slightly and linearly with increasing concn., and decreases with time at const. concn. The interfacial tension of the solutions against CCl_4 varies similarly, but the concn. effect is much greater. The observed behaviour is attributed to adsorption at the interface of a multimol. layer with alternating directions of orientation. F. L. U.

Interfacial activity of short-chain isomerides. C. C. ADDISON (Nature, 1939, **144**, 783).—The interfacial tension at the $H_2O-C_6H_6$ interface is depressed by *cis*-$PtCl_2(SEt_2)_2$ but not by the *trans* form. A similar difference is shown by citraconic and mesaconic acids, *cis*- and *trans*-CHPh:N·OH, and by some other structural isomerides. Thus orientation of small amphipathic mols. can occur in a H_2O–oil interface, although their orientation at the solution–air surface is prevented by thermal agitation. L. S. T.

Electrocapillary curve of very dilute amalgams. T. ERDEY-GRÚZ and (FRL.) O. BAJOR (Z. Elektrochem., 1939, **45**, 707—712).—An apparatus is described with which the $E_{max.}$ and $\gamma_{max.}$ vals. for dil. Zn, Cd, Tl, Pb, Sn, Bi, and Cu amalgams have been determined by the drop-wt. method. With metal concns. $<10^{-5}$ g.-atom per l. the electrocapillary curve coincides with that for Hg, but at 10^{-5}—10^{-4} (Pb 10^{-3}) g.-atom per l. $\gamma_{max.}$ rises abruptly, and $E_{max.}$ is displaced to more negative vals. owing to formation of a double layer; the displacement, which is less for the more noble metals, is influenced by the nature of the anion in the solution, indicating that ion adsorption produces a competing double layer on the solution side of the interface. A. J. E. W.

Electrocapillary curves of concentrated solutions of acids. S. JOFA and A. FRUMKIN (Acta Physicochim. U.R.S.S., 1939, **10**, 473—480).—Theoretical. The adsorption of the cation and anion may be calc. for conc. solutions of acids from the electrocapillary curves measured with reference to a H electrode in the same solution. Vals. calc. for HCl are given. F. J. G.

Changes of phase and transformations of higher order in monolayers. D. G. DERVICHIAN

(J. Chem. Physics, 1939, **7**, 931—948).—A systematic classification of the different types of isotherms in monolayers is derived from definitions of the gaseous, liquid, mesomorphous, and solid states in these systems and their relation to the corresponding three-dimensional states. Phase transformations and higher-order transitions are associated with discontinuities in compressibility, apparent dipole moment, and surface viscosity. L. J. J.

Electrical characteristics of molecular films. F. J. Norton (J. Amer. Chem. Soc., 1939, **61**, 3162—3168).—Surface potentials can be given to stearate (Pb, Cu, Ba, Ca) *X* and *Y* multi-films by applying a voltage while the films are in a conducting medium, *e.g.*, air ionised by Po. Factors affecting the potential are the p_H of the bath and the age of the film on the bath surface. On removal of the voltage the films lose their charges exponentially, the charges accumulating on the insulating surface film. If the film is a good insulator the initial charging current drops to zero, if a poor insulator to a const. current which is the conduction current of the insulator. The slow leakage of charge from *X* films exposed to air is attributed to the natural electrical conductivity of the air. Surface potentials exist on Ca stearate *X* films deposited on glass. W. R. A.

Contact potential of an iodine film on tungsten. M. J. Copley and R. W. Spence (J. Amer. Chem. Soc., 1939, **61**, 3027—3030).—The current–voltage characteristics of two W filaments, *A* and *B*, have been measured, *A* being at 2350° K. and *B* at room temp. Measurements were made (i) with *B* clean and (ii) with *B* coated with I at 1000° K. and cooled. The mean W–W + I contact potential by (ii) is —0·91 v., but when *B* was kept at room temp. during the coating process the contact potential is —0·42 v., owing to the formation of a mol., and not an at., film. The stable I film on W evaporates above 1250° K., but flashing to 2000° K. is necessary for its complete and rapid removal. The dipole moment of the adsorbed I atoms in the complete film is estimated as 1·0 D. W. R. A.

Range of molecular action of surfaces and multimolecular solvate (adsorbed) layers. B. Derjaguin, M. Kussakov, and L. Lebedeva (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 671—673; cf. A., 1937, I, 358).—The thickness, *h*, of a film formed by H_2O between a gas bubble and mica is $\sim 1{\cdot}2 \times 10^{-5}$ cm. Measured vals. of *h* at various vals. of the excess internal pressure *P* correspond with states in thermodynamic equilibrium, indicating a range of action of mol. surface forces of 2—3 $\times 10^{-5}$ cm. For electrolytes, the film collapses when *h* becomes small, and an upper limit to the thickness of stable wetting layers of liquids on solids exists. Dissolved substances alter the form of the *P–h* curve. The variation of *h* with solute concn. shows that *h* of adsorbed layers at solution–solid interfaces is $\sim 10^{-5}$ cm. The interpretation of the pressure *P* in aq. solutions is discussed. W. R. A.

New method of determination of the rate of diffusion (mobility) of molecules of surface-active substances in the interface solid–gas. P. F. Pochil (J. Phys. Chem. Russ., 1939, **13**, 146).—A droplet of oleic acid is placed on the free end of a metal plate partly immersed in H_2O. The acid spreads over the metal surface and from it over the H_2O surface; the amount transferred to the H_2O surface is determined with a surface balance. J. J. B.

Surface molecular phenomena in the process of formation of lithographic or offset moulds. I. Adsorption of oleic acid on calcium carbonate. S. A. Pletenev and A. P. Safonov (J. Appl. Chem. Russ., 1939, **12**, 847—854).—Addition of oleic acid to $CaCO_3$ results in chemisorptive formation of an oriented unimol. film around the particles. Further addition of acid is followed by adsorptive formation of oppositely oriented secondary films. R. T.

Permeability of membranes to calcium salts. A. N. Rao (Biochem. Z., 1939, **302**, 247—255; cf. A., 1933, 978).—The permeability of membranes (collodion, pig intestine) to Ca salts is usually higher when the anions are org. (*e.g.*, formate, acetate, lactate, propionate, gluconate, glycerate) than when they are inorg. (*e.g.*, Cl′, Br′, I′, NO_3', CNS, but not H_2PO_2') but there is no general correlation between ease of permeability and the mol. wt. or degree of hydration of the anions or the degree of affinity between cation and anion. Capillary-active substances (*e.g.*, saponin, lecithin, EtOH, $C_5H_{11}{\cdot}OH$, extract of peppermint) in low or moderate concn. increase permeability to $Ca^{••}$ and $Mg^{••}$, the max. effect being attained at moderate concn.; in higher concn. they decrease permeability. The concn. of active substance which produces max. increase in permeability decreases with increase in capillary activity. The surface tension of peppermint extract increases with increase in concn. W. McC.

Mobilities and radii of smoke particles. L. V. Raduschkevitsch (Acta Physicochim. U.R.S.S., 1939, **11**, 265—276).—The mobilities of particles in a stearic acid smoke were determined by measuring their rate of disappearance by diffusion to the walls of a narrow gap. The method gives vals. of the radius < those obtained by counting and determining the wt. concn. in multidisperse smokes, but approx. the same in smokes which are nearly homogeneous. F. L. U.

Ultrafiltration. IV. M. Amat and J. Duclaux (J. Chim. phys., 1939, **36**, 256—262).—A no. of inorg. and synthetic and natural org. colloidal solutions have been submitted to ultrafiltration through the SiC filters previously described (A., 1939, I, 224). Inferences are drawn regarding the size and shape of the particles. In general, neither coagulation nor adsorption occurs, and the filtration is considered to be purely mechanical. F. L. U.

Influence of "T" and "R" activation on gold colloids. G. Piccardi and E. Botti (Gazzetta, 1939, **69**, 609—614; cf. A., 1938, I, 403).—Colloidal Au solutions prepared with "T" and "R" activated H_2O are less turbid and more intensely blue in colour than solutions prepared with ordinary H_2O. O. J. W.

Colloidal graphite.—See B., 1939, 1197.

Solid-liquid transition of colloidal stearic acid. K. S. Ramaiah, M. P. V. Iyer, and K. S. G. Doss (Current Sci., 1939, 8, 360).—Sols of solid stearic acid in H_2O show a marked "Schlierung" effect which disappears at the m.p. of the acid, due to transition from rod-shaped to spherical particles. The transition is reversible, and is accompanied by an inflexion in the conductivity–temp. curve and sharp changes in intensity and depolarisation of the light scattered from the particles of the sol. L. J. J.

Interpretation of the thermodynamic properties, conductivity, and diffusion of a typical colloidal electrolyte. Laurylsulphonic acid in aqueous solution. P. van Rysselberghe (J. Physical Chem., 1939, **43**, 1049—1061).—Theoretical. F.p. and conductivity data for aq. solutions of laurylsulphonic acid are interpreted on the basis of an "average inclusive micelle" the size and charge of which vary with concn. The Nernst formula for the diffusion coeff. of an unsymmetrical electrolyte is applied to this average micelle and the main features of the experimental diffusion curve are thereby reproduced. The possibility of decomp. the average micelle into ionic and neutral micelles is discussed with reference to the applicability of Stokes' law to conductivity data. C. R. H.

Solutions of the paraffin-chain sulphonic acids as colloidal electrolytes. E. L. McBain, W. B. Dye, and S. A. Johnston (J. Amer. Chem. Soc., 1939, **61**, 3210—3216).—Conductivity and ρ_4^{25} (x = 2 to 14), n^{25} (x = 2 to 5), η^{25}, and f.p. data (x = 12) are recorded for aq. solutions of the homologous series of straight-chain sulphonic acids $C_xH_{2x+1}\cdot SO_3H$. A gradual transition in behaviour from the fully dissociated electrolytes (lowest homologues) through the intermediate members in higher concn. to the typical colloidal electrolytes (higher homologues) is observed. The latter are almost completely dissociated in extreme dilution, but with increase in concn. suddenly lose most of their conductivity through association of ion-pairs and ions to form colloidal particles of low conductivity. After passing through a well-defined min. in moderately dil. solution some of the conductivity is regained through increased formation of conducting ionic micelles. W. R. A.

Change in viscosity of cellulose nitrate solutions. VI. A. A. Morozov and A. V. Pamfilov (J. Gen. Chem. Russ., 1939, **9**, 759—765).—The fall in η of $COMe_2$ or $COMe_2$–PhMe solutions of cellulose nitrate with time is largely accounted for by diminution in structural η. R. T.

Solubility of substances of high mol. wt. VII. Thermodynamics of solutions of substances of high mol. wt. G. V. Schulz (Z. Elektrochem., 1939, **45**, 652—658; cf. A., 1939, I, 319).—The free energy changes (ΔF) in 0·1—75% solutions of cellulose nitrate (I) (mol. wt., M = 50,000—443,000) in $COMe_2$ have been determined from osmotic pressure (Π) and v.p. data. In the concn. (c) range in which Π measurements are possible ($\not>$4%) the observed ΔF vals. are only slightly > the vals. derived from the mixing entropy (ΔS^*), and ΔF depends largely on M. At higher c ΔF is $\gg$ the ΔS^* vals. and independent of M. The dependence of ΔF on T for the above solutions and for PhMe solutions of polystyrene shows that the heat term Δq is large in comparison with the entropy term $T\Delta S$, the difference increasing rapidly with c. The dilution entropy derived from the ΔF–T relation is approx. = ΔS^*, showing that the departure from ideal behaviour is due to interaction of the components, the solutions being of the "regular" type. The heat of dilution of the conc. (~50%) (I) solutions is approx. = $-\Delta F$, and the solutions are of the ideal conc. type. At still higher c residual valency linkings occur. At c < ~0·1% the solutions approximate to the ideal dil. type, and M can be determined from Π vals. The structure of the solutions is discussed. A. J. E. W.

Ultracentrifugal analysis and stability in protein systems. H. P. Lundgren and J. W. Williams (J. Physical Chem., 1939, **43**, 989—1002).—Discussion of the relations between mol. wt. (M), sedimentation const. (s), diffusion const. (D), and dissymmetry factor (f/f_0) leads to the expressions $D = (k'/^3\sqrt{M})(f_0/f)$ and $s = k''M^{2/3}(f_0/f)$ where k' and k'' are consts. Thus if M decreases, one factor of D increases and the other decreases, whilst both factors in s decrease. Therefore as a mol. dissociates, s will decrease irrespectively of changes in D. If M remains const. and the protein unfolds both s and D will decrease. Sedimentation and diffusion data for hæmoglobin (I) and phycocyan (II) show that the mols. dissociate. The increase in D and decrease in s for (I) are comparable, whereas for (II) the increase in D is negligible compared with the pronounced decrease in s. The increase in the val. of f/f_0 for (II) suggests a cleavage along the major axis on dissociation, whereas the f/f_0 val. for (I) remains const. Changes in mol. friction const. for proteins due to causes other than dissociation are discussed. C. R. H.

Protein solvation in aqueous solutions of weak acids and bases. V. A. Vilenski and A. J. Korolev (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 52—55).—There are two reactions of casein in aq. solutions of lactic, acetic, or citric acid. In addition to the usual protein salt formation there is considerable sorption of undissociated org. acid. D. F. R.

Protein structure and the Procter–Wilson theory.—See B., 1939, 1270.

Structure of colloidal gels. H. R. Kruyt (Chim. et Ind., 1939, **42**, 587—603).—A general survey. F. L. U.

Gelation and film formation. II. Clay films. E. A. Hauser and D. S. Le Beau (J. Physical Chem., 1939, **43**, 1037—1048).—It is more difficult to withdraw imbibed H_2O from films of colloidal Al silicates ["Alsifilm" (I)] made up originally of small particles than from the gel because decreasing original particle size increases the capillary interstices in the film structure. (I) dehydrated at different temp. (<700°) takes up the same amount of moisture in moist air and if immersed in H_2O swells, forms a gel, and finally peptises to the sol condition. If (I) is dehydrated at temp. >700° H_2O is not taken up even on immersion. Apparently a collapse of the lattice prevents osmotic imbibition. The treatment of (I) with electrolytes

results in base exchange. The film structure as determined by *X*-ray studies is discussed. C. R. H.

Mol. wt. of sol and gel in crude *Hevea* rubber. A. R. KEMP and H. PETERS (J. Physical Chem., 1939, **43**, 1063—1082).—The mol. wt. of sol rubber fractions in C_6H_{14} has been determined by Staudinger's η method. The average mol. wt. calc. by the Staudinger equation shows greater deviations with change in concn. than do vals. calc. from the Arrhenius equation, especially at high concns. C_6H_{14} is a better solvent than tetralin on account of the instability of the sol in the latter solvent. The η of C_6H_{14} solutions is reduced in presence of alcohols and ketones. These substances peptise gel rubber possibly on account of their polar properties bringing about a reduction in van der Waals forces. The average mol. wt. of sol rubber ranges from 60,000 to 210,000; the mol. wt. of gel rubber is $>$210,000. C. R. H.

Behaviour of colloidal suspensions with electrolytes. E. A. HAUSER and S. HIRSHON (J. Physical Chem., 1939, **43**, 1015—1036).—Mainly theoretical. The η of mixtures of sols of opposite sign, bentonite (I) and Fe_2O_3, has been investigated. When the Fe_2O_3 sol is added to the (I) sol the final equilibrium η goes through a first max. and decreases through a min., whence it goes through a second max. The min. region is one of coagulation. The first max. corresponds with the greatest extent of orientation of (I) particles around Fe_2O_3 particles, and the second max. with the greatest extent of orientation of Fe_2O_3 around (I). The electrocratic behaviour of a sol depends on the individual adsorption characteristics of the ions in the system and on the adsorption behaviour of the colloid. The less strongly the ion carrying a sign opposite to that of the sol particle is adsorbed in the diffuse layer surrounding the particle, the more powerful it is in forming gels and causing coagulation. Explanations for the different effects of uni- and multi-valent ions play a prominent part in the authors' theories of colloidal behaviour. C. R. H.

Time thresholds of the mitogenetic effect on coagulation as related to concentration of colloid and electrolyte coagulator. M. A. VLADIMIRSKAJA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 582—585).—The relationship between the concn. of colloidal V_2O_5 (0·0005—0·07%) and the time threshold of coagulation using 1N-KCl has been measured. The radiation produced was detected by a yeast culture in an agar block placed opposite a quartz window in the colloid container; the colloids were discharged both continuously and interruptedly. The time threshold increases with concn. of the colloid, and with dilution of the electrolyte. It is concluded that the radiation is connected with the coagulation of the dispersed phase and not with the dispersing medium. F. J. L.

Coagulating action of alcohols on protein solutions and the Traube rule. S. S. VASSILIEV (J. Phys. Chem. Russ., 1939, **13**, 42—55).—Coagulation of egg-albumin by the primary alcohols C_1—C_5 was measured. It cannot be due to dehydration as assumed by Kruyt since the coagulating power increases, and the affinity to H_2O decreases, with rising mol. wt. A real coagulation by dehydration, *e.g.*, with $(NH_4)_2SO_4$, is reversible whilst the effect of alcohols is irreversible. The validity of the Traube rule indicates an adsorption mechanism for the coagulation. The amount of the alcohols adsorbed by proteins is calc. J. J. B.

Equilibrium coefficients of reactions in the gaseous phase. D. O. TSCHERNOBAEV and A. G. SHIVOTOVSKI (Inst. Chem. Tech. Ukrain. Acad. Sci., 1939, pp. 5—89).—Methods of calculating equilibrium coeffs. are given for the more important industrial processes. Numerous tables are included. R. T.

Equilibrium $2COF_2 \rightleftharpoons CO_2 + CF_4$. O. RUFF and S. C. LI (Z. anorg. Chem., 1939, **242**, 272—276; cf. A., 1935, 180).—A simplified method of preparing COF_2 is described. The above reaction occurs reversibly at Ni or Pt surfaces at high temp. The decomp. of COF_2 is endothermic but the heat of the reaction could not be determined accurately. O. J. W.

Theory of L_p. V. L_p, percentage completion of reaction, and the equilibrium coefficient. N. A. TANANAEV (J. Appl. Chem. Russ., 1939, **12**, 944—948).—Theoretical. Formulæ connecting the solubility product of difficultly sol. salts with % completion of reaction with a reagent to give a difficultly sol. product are derived. R. T.

Mol. wt. of certain complex compounds of aluminium bromide. Z. A. JANKELEVITSCH and I. A. SCHEKA (J. Gen. Chem. Russ., 1939, **9**, 880—894).—Cryoscopic data suggest 1 : 1 and 1 : 2 compounds in the systems MBr–$AlBr_3$ (M = Li, Na, K, Cu^I, and Ag); mol. conductivity and degree of association of the complexes rise in the order given. Group V metals (As, Sb, Bi) yield complexes of the type $2MBr_3,Al_2Br_6$, the stability of which rises with increasing at. wt. of M. R. T.

Variation in the structure of water in ionic solutions. G. W. STEWART (J. Chem. Physics, 1939, **7**, 869—877).—The effect of dissolved NH_4Cl, LiCl, NaCl, KCl, and $MgCl_2$ on the H_2O diffraction curve for Mo $K\alpha$ radiation has been studied. The major peak is shifted to greater and the minor peak to smaller angles of diffraction to an extent increasing approx. linearly with the electrolyte concn., whilst the minor peak decreases in height relatively to the major with increasing ionic concn. Thus electrolytes cause a decrease in the amount of 4-co-ordinated H_2O structure, increasing the density. The change resembles that produced by rise of temp., and is not confined to the shell immediately adjacent to the ion. It is shown by measurement of the height of the minor peak that this change in H_2O structure can be correlated with the variation of the apparent mol. ionic vol. in solutions of 15 strong electrolytes. The effect outweighs the Debye–Hückel electrostatic effect. L. J. J.

Electrostatic effects on ionisation constants. E. C. BAUGHAN (J. Chem. Physics, 1939, **7**, 951—958).—Theoretical. The variations in the heats of ionisation of acids and bases with temp. are explained quantitatively by Born's equation for self-energy of an ion, and ionic radii are predicted. L. J. J.

Second ionisation constant of oxalic acid from 0° to 50°. H. S. HARNED and L. D. FALLON (J. Amer. Chem. Soc., 1939, **61**, 3111—3113).—From measurement of the e.m.f. of the cells $H_2|NaHC_2O_4$ (xm_1), $Na_2C_2O_4$ (xm_2), NaCl (xm_3)|AgCl–Ag, where m = max. concn. and $x \not> 1$, the ionisation const. K_2 of HC_2O_4' has been determined at 5° intervals from 0 to 50°, and $\log K_2 = \bar{5}\cdot771—0\cdot0008160 - 6 \times 10^{-5}\theta^2$. Vals. of ΔH and ΔC_p of the ionising reaction have been evaluated from the vals. of log K_2. W. R. A.

Measurements of osmotic pressure by means of isothermal distillation. Dependence on concentration with simple organic substances in water. K. HESS and L. A. SURÁNYI (Z. physikal. Chem., 1939, **184**, 321—346).—The influence of experimental conditions on the accuracy of the isothermal distillation method (cf. Ulmann, A., 1933, 690) for measuring osmotic pressure has been studied. Measurements made with sucrose solutions by this method agree well with those obtained by the cryoscopic and ebullioscopic techniques, but not with the results obtained by the use of semipermeable membranes, which are considered to be inexact. The measurements with sucrose confirm the validity of the van 't Hoff law over a large concn. range. Raffinose in the concn. range 0·01—0·5% has the normal osmotic pressure of a trisaccharide. Measurements with solutions of fumaric and maleic acid diamides give evidence of association of the latter. Measurements with solutions of Na and of Zn dodecyl sulphates of increasing concn. confirm the existence of a crit. concn. at which mol. aggregation occurs. O. J. W.

Activity of water in sulphuric acid at 25° by the isopiestic method. H. SHEFFER, A. A. JANIS, and J. B. FERGUSON (Canad. J. Res., 1939, **17**, **B**, 336—340; cf. A., 1939, I, 566).—The activities of H_2O in aq. solutions of NaCl and of H_2SO_4 have been compared over a range of concn. extending up to that of the saturated salt solution. The results give the exact position of the m_1/m_2 curve, concerning which there was previously some doubt, and indicate qualitatively the second dissociation of the H_2SO_4. T. H. G.

Activity coefficients in concentrated aqueous solutions of strong electrolytes described by a formula containing the mean ionic diameter as single parameter. I. Theory and application to the alkali chlorides, bromides, and iodides. P. VAN RYSSELBERGHE and S. EISENBERG (J. Amer. Chem. Soc., 1939, **61**, 3030—3037).—A one-parameter formula has been derived for the activity coeff. of strong electrolytes, the parameter being the distance of closest approach (s) between positive and negative ions (mean ionic diameter). For this the van der Waals or covol. terms are derived from the Ursell theory (Proc. Camb. Phil. Soc., 1927, **23**, 685). Only at high concns. do activity coeffs. become sufficiently sensitive functions of s to make the determination of this parameter really precise. The theory has been applied successfully to 15 alkali halides; the mean ionic diameters are obtained, and indications as to the extent of hydration, penetration of ions, etc. are obtained by comparison of these diameters with the sums of the ionic radii in crystals. Activity coeffs. in 0·001M. and 0·01M. solutions of the alkali halides are calc. from the mean ionic diameters obtained at high concns., and for 50% the agreement with practice is satisfactory. W. R. A.

Complete phase diagrams with respect to pressure, temperature, and composition of binary systems with vapour pressure maxima in the liquid mixtures. III. E. JÄNECKE (Z. physikal. Chem., 1939, **184**, 373—376; cf. A., 1938, I, 622).—A reply to the criticisms of Vogel (A., 1938, I, 200). O. J. W

Binary mixtures of substances melting at low temperatures. M. FEDOROVA (Acta Physicochim. U.R.S.S., 1939, **10**, 539—554).—The systems A–N_2, A–O_2, A–CH_4, and N_2–CH_4 have been studied by determination of heat capacity–temp. curves, and equilibrium diagrams are given. The results for A–O_2 and A–CH_4 do not agree with those of Veith and Schröder (A., 1937, I, 412); the peritectic in the former is at 20—21% A, m.p. 55·1° K., and the point of equal concn. in the latter is at 60% CH_4. In the other two systems the liquidus and solidus in the region of greater concn. of N_2 merge into a single horizontal line at the m.p. of N_2. F. J. G.

Crystallisation, especially from a melt, of a substance to which a second coloured crystalline substance has been added. Pro-eutectic crystallisations frequently coloured by microscopic inclusions and eutectic crystallisations. J. SEIGLE (Chim. et Ind., 1939, **42**, 607—628; cf. A., 1939, I, 139).—The phenomena observed when a fused mixture of a principal cryst. substance ($COPh_2$, NPh:NPh, $C_{10}H_8$, etc.) and a small proportion of a second substance (I, Sudan-red) is allowed to solidify in a thin film between glass slides are described and discussed. F. L. U.

Magnetic studies in the system chromium–arsenic. H. HARALDSEN and E. NYGAARD (Z. Elektrochem., 1939, **45**, 686—688; cf. A., 1938, I, 187).—χ measurements in conjunction with Debye–Scherrer photographs show that the homogeneous α- and γ-phases possess no well-defined regions of stability, that of the γ-phase being confined to the concn. range $CrAs_{0\cdot9}$—$CrAs_{0\cdot95}$ at low temp.; no phase containing more As than $CrAs_{0\cdot95}$ can be isolated. The β-phase occurs at ~40—42 at.-% As. The α- and γ-phases show weak paramagnetism, which is nearly independent of temp. The β-phase is strongly magnetic; the Weiss law is obeyed at high temp. (Θ —50°), and at low temp. χ depends on the field strength. As the β-phase structure is of a transitional type, its ferromagnetism is ascribed to lattice defects. The $\mu_{eff.}$ vals. show that the linkings are not fully ionic in the γ-phase and still less ionic in the α-phase, for which the moment indicates one uncompensated spin; linkings with antiparallel spins may occur. The β-phase contains Cr atoms with one and two uncompensated spins, but no free $Cr^{\cdot\cdot}$ ions. The system is compared with the systems Cr–S, –Se, and –Te. A. J. E. W.

System sodium ferrite–sodium aluminate. N. A. TOROPOV and N. A. SCHISCHACOV (Acta Physicochim. U.R.S.S., 1939, **11**, 277—286).—The existence

of a continuous series of solid solutions is indicated by determinations of n and by the X-ray examination of mixtures heated at 1500°. F. L. U.

X-Ray studies of compounds in the system $PbO-SiO_2$. H. F. McMurdie and E. N. Bunting (J. Res. Nat. Bur. Stand., 1939, **23**, 543—547).—X-Ray diffraction measurements on various mixtures of PbO and SiO_2 after heating and quenching confirm the existence of the compounds PbO,SiO_2 (I), $2PbO,SiO_2$, and $4PbO,SiO_2$ (II). (I) is identical with alamosite, and (II) is shown to exist in at least two forms. The patterns obtained with α- and β-PbO confirm the measurements of Darbyshire (A., 1932, 326). J. W. S.

Ternary system benzene–toluene–naphthalene. V. M. Kravtschenko (J. Phys. Chem. Russ., 1939, **13**, 132—145).—The following eutectic points were found: C_6H_6 12·35, PhMe 87·65%, $-100·6°$; $C_{10}H_8$ 3, PhMe 97%, $-96°$; $C_{10}H_8$ 20·2, C_6H_6 79·8%, $-3·6°$; $C_{10}H_8$ 2, C_6H_6 11, PhMe 87%, $-102·0°$. J. J. B.

Conditions of phase equilibrium in systems containing halides and free halogens. III. Tensimetric study of the system H_2O–Br–KBr. G. P. Lutschinski (J. Gen. Chem. Russ., 1939, **9**, 708—713).—At 20° the v.p. of Br is $\propto$ [Br] of the system H_2O–Br, up to saturation; that of H_2O falls slightly. The [Br] of the vapour rises rapidly with increasing [Br] of the aq. phase, up to 0·5%. Azeotropic points were not found in the system. In the system H_2O–Br–KBr the v.p. of Br falls with rising [KBr]. R. T.

Equilibria in the system carbamide–ammonium nitrate–water. V. A. Sokolov (J. Gen. Chem. Russ., 1939, **9**, 753—758).—Phase diagrams are given for the interval $-26·5°$ to 25°. $CO(NH_2)_2$ and NH_4NO_3 are mutually sol., and yield two series of solid solutions. β-Rhombic NH_4NO_3 does not dissolve $CO(NH_2)_2$. R. T.

Thermal equilibrium between niobium pentoxide and carbon. P. Süe (J. Chim. phys., 1939, **36**, 280—282).—The total pressure ($CO + CO_2$) developed in the reaction $Nb_2O_5 + C \rightleftharpoons Nb_2O_4 + CO$ has been measured at temp. from 715° to 810°. The heat of formation of Nb_2O_4 calc. by Nernst's formula is 393 kg.-cal., confirming the val., 387 kg.-cal., previously found (A., 1939, I, 322). F. L. U.

Heats of formation of green manganese sulphide and anhydrous manganese chloride. A. Könneker and W. Biltz (Z. anorg. Chem., 1939, **242**, 225—228).—The following vals. are obtained: Mn (solid) + S (rhomb.) = MnS (green) + 44·8 kg.-cal.; Mn (solid) + Cl_2 (gaseous) = $MnCl_2$ (solid) + 111·6 kg.-cal.; Mn (solid) + FeS (solid) = MnS (solid) + Fe (solid) + 22·0 kg.-cal. O. J. W.

High-temperature calorimetry of alloys. O. Kubaschewski and A. Walter (Z. Elektrochem., 1939, **45**, 732—740).—Heats of reaction ($-q$) of the following binary mixtures have been determined for various proportions of the constituents, using a special high-temp. calorimeter (cf. A., 1939, I, 579): Ca–Bi, –Pb, –Tl, –Sb, Mg–Sb, –Sn. In each case the highest $-q$ vals. (~23, 16, 18, 32, 14, and 5·5 kg.-cal. per g.-atom, respectively) correspond with the intermetallic compounds of highest m.p. A. J. E. W.

Free energy of dolomite formation. F. Halla (Z. physikal. Chem., 1939, **184**, 446—447; cf. A., 1936, 290).—Earlier data are corr. For the reaction calcite + magnesite = dolomite $\Delta F°$ at 25° is calc. to be 700 ± 30 g.-cal. The solubility product of dolomite at 25° is $2·7 \times 10^{-17}$. The formation of dolomite takes place with decrease of vol. O. J. W.

Behaviour of phosphoric acid solutions as ideally concentrated solutions. I. D. Judin (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 804—807).—In order to determine whether solutions of H_3PO_4 behave as ideally conc. solutions according to the Nernst equation $(\partial Q/\partial N)_{N=N_2} - (\partial Q/\partial N)_{N=N_1} = A$, the heat of dilution ($Q$) of H_3PO_4 has been determined for various concns. Curves between N and Q and N and A are not parallel, nor do they completely merge. A. J. M.

Conversion energies. B. Bružs (Z. Elektrochem., 1939, **45**, 703—706).—A theoretical discussion of the reciprocity principle in thermodynamics. A. J. E. W.

Osmotic pressure, redox potential, affinity. G. L. de Haas-Lorentz (Chem. Weekblad, 1939, **36**, 782—785).—The relationships between these quantities are discussed mathematically in connexion with intensity parameters and the laws of thermodynamics. S. C.

Certain physico-chemical properties of moist salts of strong electrolytes, determined by measuring the dielectric constant and the conductivity. C. I. Borakso, L. I. Grudkova, and K. P. Mischtschenko (J. Appl. Chem. Russ., 1939, **12**, 981—985).—The dielectric const. and conductivity of powdered inorg. salts rise parallel with increasing moisture content, for non-hydrated salts. In the case of hydrated salts no change is observed, up to a certain limit. R. T.

Properties of electrolytes in mixtures of water and organic solvents. IV. Transference numbers of hydrochloric acid in water and dioxan–water mixtures from 0° to 50°. H. S. Harned and E. C. Dreby (J. Amer. Chem. Soc., 1939, **61**, 3113—3120; cf. A., 1939, I, 565).—E.m.f. measurements have been made of the cells Ag–AgCl|HCl (m), dioxan (X), H_2O (Y)|HCl (r), dioxan (X), H_2O (Y)|AgCl–Ag for 0, 20, 45, 70, and 82% aq. dioxan at 5° intervals from 0° to 50°, and from 0·005M- to 3·0M-HCl. From these the cation transference no. has been calc. and the limiting transference no. has been obtained by extrapolation for all the solutions over the entire temp. range. The limiting law of the Onsager conductance theory is obeyed by H_2O and by 20, 45, and 70% aq. dioxan, but data on 82% aq. dioxan are less definite. W. R. A.

Transport numbers and diffusion potentials in molten salts. K. E. Schwarz (Z. Elektrochem., 1939, **45**, 740—743).—A concept of transport nos. (n) in molten salt mixtures is developed, and expressions are derived for n (which is $\propto$ the concn. of the constituent) and the diffusion potential in typical

cases. Molten salt systems are compared with liquid metals. A. J. E. W.

Electrolytic migration on metallic surfaces. K. E. Schwarz (Z. Elektrochem., 1939, **45**, 712—714).—Deposits of Po on the surface of an electrically-heated Ag wire at 250—450° migrate towards the anode, the distance of migration being approx. $\propto$ (time)$^{\frac{1}{2}}$; the rate increases with temp. The effect is marked even with potential gradients of 0·1 v. per cm., but is very sensitive to impurities and surface conditions. A. J. E. W.

So-called electrolytic solution tension of the crystal surface of metals. I. Zinc. K. Maruyama (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 789—797).—The normal potentials of Zn for the cryst. surfaces (0001), (10$\bar{1}$0), and (11$\bar{2}$1) relative to the normal H electrode, measured at 25° in HCl solution, are 870, 851, and 809 mv., respectively. L. J. J.

Polarisation during recharging of tin ions. O. Essin and M. Loschkarev (Acta Physicochim. U.R.S.S., 1939, **10**, 513—528).—The cathodic and anodic polarisations at a Hg jet electrode in solutions containing $SnCl_4$, $SnCl_2$, and HCl have been studied. The results can be accounted for in terms of slow dissociation of complex Sn^{IV} ions and slow diffusion and slow discharge of $Sn^{\cdot\cdot\cdot\cdot}$. F. J. G.

Cathodic polarisation in electrolysis of molten salts. (A) S. Karpatschev. (B) S. Pletenev (J. Phys. Chem. Russ., 1939, **13**, 147).—(A) Criticism of a paper by Pletenev and Rosov (A., 1939, I, 84) and (B) a reply. J. J. B.

Hydrogen overvoltage on lead and capacity of the lead electrode. B. Kabanov and S. Jofa (Acta Physicochim. U.R.S.S., 1939, **10**, 617—629).—The H overvoltage on a clean Pb surface is > that on all other metals including Hg, and the slope of the curve has the normal val. Abnormalities found by earlier workers were due to a contaminated surface. The overvoltage is almost independent of [H_2SO_4]. The true surface was determined by measuring the capacity of the double layer. At potentials more positive (against H) than $-0·6$ v. the capacity increases markedly owing to adsorption of SO_4'' ions. F. J. G.

Overvoltage of hydrogen in liquid ammonia. V. A. Pleskov (Acta Physicochim. U.R.S.S., 1939, **11**, 305—314; cf. A., 1936, 161).—The overvoltage (η) of H on Ni in a solution of NH_4Cl in liquid NH_3 at $-50°$ varies with the c.d. in accordance with Tafel's equation over the range 10^{-7}—10^{-4} amp. per sq. cm. The abs. vals. of η are 0·2 v. > those in aq. HCl with a Ni cathode, and 0·8—0·9 v. higher with a Hg cathode. F. L. U.

Electrochemical study of corrosion of metals.—See B., 1939, 1248.

Theory of thermal explosion. II. Thermal explosion for unimolecular reactions. O. M. Todes and P. V. Melenteev (Acta Physicochim. U.R.S.S., 1939, **11**, 153—180; cf. A., 1937, I, 189).—Isothermal and adiabatic reactions, ignition limits, period of induction, and ignition by adiabatic compression are treated mathematically. F. L. U.

Rate of dissociation of sulphur vapour. H. Reinhold and K. Schmitt (Z. physikal. Chem., 1939, **B**, **44**, 98—108, and Z. Elektrochem., 1939, **45**, 706).—The electrical conductivity (κ) of Ag_2S in contact with S vapour (cf. A., 1940, I, 14) depends on the form of the apparatus used; the observed κ val. is smaller if the Ag_2S and the solid or liquid S are separated by a capillary. The effect is due to the small rate of dissociation and recombination of the S mols., the stationary concns. of the various mol. species not being equal to their equilibrium vals. owing to diffusion effects. A streaming method for determining the rates is developed; the time of half-change for an unspecified dissociation reaction in S vapour is ~1 min. A. J. E. W.

Kinetics of the thermal decomposition of ethyl formate. R. F. Makens and W. G. Eversole (J. Amer. Chem. Soc., 1939, **61**, 3203—3206).—The thermal decomp. of HCO_2Et, studied at 300°, 375°, 400°, and 425°, produces the same gaseous products (CO_2, C_2H_4, H_2, CO, CH_4, C_2H_6, higher unsaturated compounds). At <375° the reaction is slow. The sp. velocity coeffs. are $k_{375°} = 0·824 \times 10^{-4}$, $k_{400°} = 2·441 \times 10^{-4}$, $k_{425°} = 7·61 \times 10^{-4}$, which yield an energy of activation of 40,010 g.-cal. per mol. The principal primary reaction in the decomp. is a first-order reaction, $HCO_2Et \rightarrow C_2H_4 + HCO_2H$, and this is followed by the decomp. of the HCO_2H producing CO, H_2O, CO_2, H_2, and CH_2O, and probably by polymerisation of C_2H_4 to butylene and higher polymerides. The nature of other possible minor primary reactions is considered. W. R. A.

Homogeneous decomposition of ethyl chlorocarbonate. A. R. Choppin, H. A. Frediani, and G. F. Kirby, jun. (J. Amer. Chem. Soc., 1939, **61**, 3176—3180).—$ClCO_2Et$ undergoes homogeneous unimol. decomp. to EtCl and CO_2 between 150° and 200° and from 10 to 700 mm. Hg. The sp. reaction rate, determined from the slopes of the pressure–time curves, is $5·5 \times 10^{-10}e^{29,410/RT}$. In view of the negligible influence of packing on the decomp., no appreciable surface catalysis was anticipated. Pressure measurements of the decomp. in clean vessels, however, fluctuated slightly, and two runs with the same vessel were necessary before this effect disappeared. The rate coeff. falls appreciably at low pressures, and the reaction becomes approx. second order. W. R. A.

Highly polymerised compounds. CCXXIII. Kinetics of chain polymerisations. VIII. Branching reactions. G. V. Schulz (Z. physikal. Chem., 1939, **B**, **44**, 227—247).—From studies of the degree of branching of polystyrene chains (cf. A., 1936, 146) it is inferred that the polymeride mol. has a principal axis from which shorter side-chains branch. The various forms which this branching can take are discussed. Simple ramification of the mol. chain leads to sol. polymerides, but the formation of closed rings, as is induced by the presence of divinylbenzene (A., 1934, 879), leads to insol. polymerides. J. W. S.

Combustion zones of butaldehyde, *iso*butaldehyde, propaldehyde, acetaldehyde, glyoxal, and acraldehyde.—See A., 1940, II, 6.

Explosion ranges of gaseous mixtures. VI. Influence of temperature on limits of detonation of hydrogen–air mixtures. A. SOKOLIK (Acta Physicochim. U.R.S.S., 1939, **11**, 239—250; cf. A., 1938, I, 201).—The lower limit of explosion in H_2–air mixtures initiated by the detonation of $2H_2 + O_2$ is at ~21% of H_2 and is not affected by varying the temp. of the mixture between 20° and 150°. Above 200° the limit is lowered to 17—18%. H_2O formed in the initial stages hinders the formation of the explosion wave. The explosion wave is weakened by passage down a temp. gradient, but only if the composition of the mixture is near the limiting val.
F. L. U.

Development of detonation in gases. K. I. SCHTSCHOLKIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 636—640).—Using the mixture $C_5H_{12} + 8O_2 + 3N_2$, a mechanism has been sought for the accelerated propagation of the flame which precedes the detonation of a combustible mixture contained in a tube and ignited by an electric spark. It is concluded that the turbulence of the gas stream, due to the expansion of burning gases, in front of the propagating flame during pre-detonation is the responsible factor. On this theory pulsations are set up in the gas which cause the stream of burning gases to mix with a fresh supply of gas. The front of the flame becomes jagged, its surface extends considerably, and the linear velocity of propagation increases. Calculations based on this theory are made on the mixtures H_2 + air, $H_2 + O_2$, C_2H_2 + air, $CO + O_2$, and $CH_4 + O_2$. W. R. A.

Thermal decomposition of ethane under higher pressure. H. THEILE (Z. physikal. Chem., 1939, **B, 44**, 41—52).—The unimol. velocity coeff. for the decomp. of C_2H_6, alone and in presence of CO_2, falls with increasing pressure in the range 1—10 atm. This confirms the chain mechanism of Küchler and Theile (A., 1939, I, 326). The activation energies of the partial reactions of the chain mechanism are estimated; they reproduce the observed activation energy, and also that for the hydration of C_2H_4.
F. J. G.

Conditions of ignition of gaseous mixtures. XIII. Influence of admixture of organic peroxides on formation of cold flames of butane. E. I. BLAT, M. I. GERBER, and M. B. NEIMAN (J. Gen. Chem. Russ., 1939, **9**, 732—747).—The crit. pressures of explosive decomp. of Et_2O_2 or MeO_2H are given by $\log p = A/T - B$, where A and B are consts. The induction period τ of formation of a cold flame of C_4H_{10} is greatly shortened by introduction of peroxides; expressions connecting τ with temp., pressure, and peroxide content are derived. R. T.

Combustion of boiling explosives. A. F. BELAIEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 254—256; cf. B., 1939, 554).—The combustion of boiling $MeNO_3$ and $(CH_2{\cdot}NO_3)_2$ under various conditions is described. The presence or absence of boiling greatly affects the nature of explosive decomp. produced by ignition, the combustion rate being probably 100 times as great in presence as in absence of boiling. Detonation appears to be a secondary effect.
C. R. H.

Kinetics of the cracking of hydrocarbons under pressure. II. Naphthenic hydrocarbons. III. Aromatic hydrocarbons. M. D. TILITSCHEEV (J. Appl. Chem. Russ., 1939, **12**, 735—740, 741—758; cf. A., 1939, I, 375).—II. The velocity coeffs. for the cracking of *cyclo*-propane, -pentane, and -hexane (I), dekalin, tetralin, and phenyl*cyclo*hexane (II) at 425°, 450°, 500°, 550°, 575°, and 600° are determined from literature data and new experimental results. The cracking of naphthenes (>4 C atoms) is 20—25 times slower than that of paraffins having the same no. of C atoms. Equations connecting log k with T are given. The activation energy for the cracking of naphthenes is 65,000 g.-cal. per mol. The prep. of (II) from C_6H_6, (I), and $AlBr_3$ is described.

III. The velocity coeffs. for the cracking of aromatic and polycyclic hydrocarbons and of their derivatives are determined from literature data supplemented by new results. Vals. for the activation energies are given. The reactions are of the first order. D. G.

Liquid-phase reactions at high pressures. V. Polymerisation of *cyclo*pentadiene and α-di*cyclo*pentadiene. VI. Explosive decomposition of *cyclo*pentadiene. B. RAISTRICK, R. H. SAPIRO, and D. M. NEWITT (J.C.S., 1939, 1761—1769, 1770—1773).—V. The liquid-phase polymerisation of *cyclo*pentadiene (I) at pressures ≯5000 atm. over a temp. range 0—40° has been examined. Increases of pressure and temp. increase the rate of polymerisation. At low pressures and temp. only α-di*cyclo*pentadiene (II) is formed whilst at high pressures and temp. explosive decomp. occurs. Between these two pressure–temp. regions is a narrow region in which, in addition to (II), trimeride and tetrameride are formed. Similar polymerides are formed by subjecting (II) to pressure at 138°, but (II) first dissociates into (I) before forming the tri- and tetra-meride. The activation energy term and the collision factor of the Arrhenius equation show increases with increase in pressure.

VI. The explosive decomp. of (I) at high pressure and temp. yields a carbonaceous residue and a considerable quantity of gas. The min. crit. carbonisation pressure (P) is increased by diluting (I) with n-C_8H_{18}, AcOH, or EtOAc. P is also influenced by the dimensions and material of the reaction vessel. X-Ray analysis [H. L. RILEY] of the residue shows it to be composed of cylinders of average height and diameter 30·2 A. and 14·5 A., respectively. It cannot be classed as either graphitic or amorphous but is comparable with low-temp. coke prepared at 550—600°. The gas formed is mainly CH_4 and since (I) contains no C attached to more than two H atoms, hydrogenation of CH⋮ or CH_2⁚ groups must take place. The large amount of energy released during carbonisation is shown by the decomp. of stable compounds dissolved in (I) when subjected to the reaction; *e.g.*, NH_2Ph and C_5H_5N give NH_3, CCl_4 gives HCl, and thiophen gives H_2S. Possible mechanisms of the reaction are discussed. C. R. H.

Reaction between hydrogen sulphide and sulphur dioxide in aqueous media. N. S. NIKOLAEV (J. Appl. Chem. Russ., 1939, **12**, 1013—1021).—A study of the kinetics of the reaction in H_2O and

3·5 and 15% HCl suggests the mechanism: $2H_2S + SO_2 \rightarrow H_4S_3O_2$; $2H_4S_3O_2 \rightarrow 3S_2 + 4H_2O$. R. T.

Oxidation of solutions of ferrous chloride in alcohols. J. R. POUND (J. Physical Chem., 1939, **43**, 969—980).—The rate of bimol. oxidation of alcoholic solutions of $FeCl_2$ increases with the mol. wt. of the alcohol, the rate in *iso*-C_8H_{17}·OH being 100 times that in EtOH. H_2O and acids decrease the oxidation rate especially with the higher alcohols. The Fe^{III} salt formed complicates the reaction by oxidising the alcohol to aldehyde. The electrical conductivity of the solutions increases during oxidation. C. R. H.

***trans–cis* Isomerisation of cobaltic complexes.** J. BRÜLL (Compt. rend., 1939, **209**, 630—632).—The rate of *trans–cis* isomerisation of [Co en_2X_2] salts [X_2 = Cl_2, Br_2, (H_2O)Cl] at 18° has been determined by absorption coeff. measurements at 5100—5460 A., using aq. solutions containing 0·01 g.-mol. per l. of the complex with KCl, KBr, or HCl to inhibit hydration. The reactions are unimol. (k = 1·69, 7·82, and 6·66 × 10^{-4}, respectively). No isomerisation occurs if X_2 = $(NH_3)_2$, (H_2O)(NH_3), or (NH_3)Cl. If X = H_2O k is reduced from 4·73 × 10^{-3} to 9·5 × 10^{-4} by 0·003 g.-mol. per l. of HBr. A. J. E. W.

Application of artificial radio-elements to the elucidation of problems of complex chemistry. A. A. GRÜNBERG and P. M. FILINOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 912—914).—All the Br atoms in $PtBr_4''$ and $PtBr_6''$ containing radioactive Br are freely exchangeable with inactive Br in solutions containing Br′. The rate of exchange has been measured in the case of $PtBr_4''$. L. J. J.

Activation energy and entropy of the transition state. J. K. SIRKIN and M. A. GUBAREVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 686—688).—Theoretical. The kinetics of the reaction between $NPhMe_2$ and EtI in C_6H_6, EtOH, and C_6H_6–EtOH mixtures have been studied at 35°, 45°, and 55°; $k_{EtOH} \simeq 20k_{C_6H_6}$. The energy of activation in EtOH is 6000 g.-cal. > in C_6H_6. W. R. A.

Herz's reaction. N. S. DROZDOV and V. A. IGNATIUK-MAISTRENKO (J. Appl. Chem. Russ., 1939, **12**, 1065—1072).—The velocity of hydrolysis of thiazthionium chlorides to the corresponding bases ∝ p_H of the medium. In view of side-reactions (formation of resins at high p_H, and decomp. of the base at low p_H), a certain optimum p_H exists for the hydrolysis of each individual chloride. R. T.

Hydrogen exchange of dimethyl sulphone and sodium methylsulphonate in alkaline solution. J. HOCHBERG and K. F. BONHOEFFER (Z. physikal. Chem., 1939, **184**, 419—428).—When Me_2SO_2 is dissolved in alkaline D_2O the following exchange occurs, even at room temp.: $Me_2SO_2 + OD' = MeSO_2{\cdot}CH_2' + HDO$. Reaction velocity measurements at 0—63·5° show that the velocity coeff. (min.$^{-1}$) for 1·0N. [OD′] is given by: $\log k = 13{\cdot}23 - 4035/T$. For $MeSO_3Na$ the exchange reaction is $MeSO_3' + OD' = CH_2{\cdot}SO_3'' + HDO$, and for the range 100—183° $\log k$ for 1·0N. [OD′] is given by: $\log k = 12{\cdot}00 - 5630/T$. The activation energies for the two reactions are 18·5 and 25·7±1 kg.-cal., respectively. O. J. W.

Claisen rearrangement. I. Kinetic study of the arrangement of *p*-tolyl allyl ether in diphenyl ether solution. J. F. KINCAID and D. S. TARBELL (J. Amer. Chem. Soc., 1939, **61**, 3085—3089).—The rate of the rearrangement of *p*-tolyl allyl ether (I) in Ph_2O solution has been measured at 214·7° [14·22% (I)], 200·6° [4·77, 13·30, 22·81, 100% (I)], and 185·8° [14·22, 100% (I)], by determining the phenol formed by quant. acetylation with C_5H_5N and Ac_2O. The reaction is unimol. and the initial rate of rearrangement is the same in solution and in the pure liquid state. The rate is not appreciably affected by addition of 10% of $NPhMe_2$, 1% of AcOH, or by the presence of air or O_2. The rearrangement is ≮95% quant. at 200° in solution. The energy of activation is 33·1 kg.-cal. per mol. W. R. A.

Exchange reaction of nuclear hydrogen atoms of phenol. II. Exchange reaction in acid solution. M. KOIZUMI (Bull. Chem. Soc. Japan, 1939, **14**, 353—362; cf. A., 1939, I, 150).—The velocity coeff. k for the exchange reaction in HCl solution, referred to the stoicheiometric equation $PhOH + HOD = C_6H_4D{\cdot}OH + H_2O$, ∝ $[HCl]^{1{\cdot}26}$. In the expression $= Ze^{-E/RT}$, E is independent of [HCl] and ~27,300 g.-cal., whereas Z increases with increasing [HCl]. The true velocity coeff., referred to the actual reaction $PhOH + DH_2O^{\cdot} = C_6H_4D{\cdot}OH + H_3O^{\cdot}$, and in terms of $[H_3O^{\cdot}]^{1{\cdot}26}$, is given independently of [HCl] by $k_0 = 10^{12{\cdot}5} \exp.(-27{,}300/\boldsymbol{R}T)$. F. J. G.

Mechanism of the hydrolysis of $\alpha\gamma$-dimethylallyl chloride. C. L. ARCUS and J. W. SMITH (J.C.S., 1939, 1748—1749).—The hydrolysis of CHMe:CH·CHMeCl (I) in aq. $COMe_2$ has been followed by conductometric determination of the HCl formed, and shown to follow a unimol. law. The apparent incompleteness of the reaction is attributed to adsorption of (I) on the Pt-black of the electrodes in the cell. J. D. R.

Relations between electrostatic potentials and reaction velocities. H. O. JENKINS (J.C.S., 1939, 1780—1784).—In the alkaline hydrolysis of a series of benzoic esters a linear relation has been discovered between the energy of activation (E) and the electrostatic potential at the C atom to which the CO_2Et group is attached (ψ). The decrease in E when a substituent is introduced which alters ψ by one abs. unit of potential is of the same order of magnitude as the work done in bringing up 1 g.-mol. of OH′ through one abs. unit of potential. This is held to be proof of the correctness of the electrical interpretation of the reaction. C. R. H.

Mechanism of the reaction of monobromoacetate and hydroxyl ions. Á. VON KISS and I. BOSSÁNYI (Acta chem., min. phys. Univ. Szeged, 1936, 5, 10—17; Chem. Zentr., 1937, i, 3302).—The velocity of the reaction $CH_2Br{\cdot}CO_2' + OH' = OH{\cdot}CH_2{\cdot}CO_2' + Br'$ at 65°, in dil. solutions containing $Na^{\cdot}$, is in quant. agreement with the Brönsted–Debye–Hückel equation for ionic strengths ≯0·02, if allowance is made for the hydrolysis of $CH_2Br{\cdot}CO_2'$, which introduces an abnormal salt effect. A. J. E. W.

Mechanism of the reaction of [α-]acetoxy-propionate and hydroxyl ions. A. VON KISS and R. KUKAI (Acta chem., min. phys. Univ. Szeged, 1936, **5**, 17—26; Chem. Zentr., 1937, i, 3302).—The velocity of the reaction at 5—45°, in presence of Na, Li, K, Ca, Sr, and Ba ions, with and without added $NaNO_3$, K_2SO_4, or KCl, is studied. The reaction is bimol. and occurs in oriented collisions, the no. of which depends on the relative concns. of the reactants. A. J. E. W.

Exchange of chlorine substituted in aromatic compounds for amino-groups. VI. Kinetics of reaction of *m*-chloronitrobenzene with aqueous ammonia in presence of cupric chloride. VII. Kinetics of reaction of 2-chloroanthraquinone with aqueous ammonia. VIII. Kinetics of reaction of *p*-chloroaniline, 1-chloronaphthalene, and sodium 1-chloronaphthalene-4-sulphonate with aqueous ammonia in presence of cuprous chloride. N. N. VOROSHCOV, jun., and V. A. KOBELEV (J. Gen. Chem. Russ., 1939, **9**, 1465—1467, 1515—1516, 1569—1576).—VI. m-$C_6H_4Cl{\cdot}NO_2$ does not react with aq. NH_3 in absence of $CuCl_2$; in its presence m-$NH_2{\cdot}C_6H_4{\cdot}NO_2$ is obtained in 26—42% yield at 220°. The velocity of the reaction $\propto$ [$CuCl_2$], but is independent of the [NH_3]. It is expressed by $\log k = 5{\cdot}387 - 2933/T$; the temp. coeff. C is 1·33, and the activation energy E is 13·7 kg.-cal.

VII. The velocity of reaction of 2-chloroanthraquinone with aq. NH_3 at 200° $\propto$ concn. of the substrates; it is expressed by $\log k = 6{\cdot}26 - 4467/T$. The val. of C is 1·57, and of E 20·5 kg.-cal.

VIII. The velocity of reaction of p-$C_6H_4Cl{\cdot}NH_2$, 1-$C_{10}H_7Cl$, or 1 : 4-$C_{10}H_6Cl{\cdot}SO_3Na$ with aq. NH_3 in presence of CuCl $\propto$ concn. of Cl-compound and of CuCl, but not of NH_3. The velocities are expressed, respectively, by $\log k = 4{\cdot}95 - 2732/T$, $3{\cdot}98 - 2632/T$, and $4{\cdot}314 - 2677/T$. The vals. of C are 1·32, 1·30, and 1·29, and of E 12·5, 12·0, and 12·2 kg.-cal., respectively. Amination is preceded by formation of double compounds of the type $RCl,Cu(NH_3)_2$. R. T.

Auto-oxidation of oleic acid, methyl oleate, oleyl alcohol, and *cis*-Δ^{ι}-octadecene.—See A., 1940, II, 4.

Carbon dioxide reduction. D. A. FRANK-KAMENETZKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 663—665).—The kinetics of the reduction of CO_2 by activated ash-free sugar C have been measured under static conditions by a method similar to that of Broom and Travers (A., 1932, 577) at 600—900° and at pressures of 50—200 mm. Hg. The course of the reaction was followed by measuring the thermal conductivity of the gas mixture. With a surface-cleaned C a measurable reaction takes place at $\not<$600°, and between 600° and 750° the reaction is $CO_2 + C = CO + (CO)$ (I), where (CO) denotes a surface oxide of C which can be regarded as chemisorbed CO. In this temp. range the total pressure, after an initial drop, remains approx. const. From 750° to 900° a steady increase in pressure is found, which in the initial stages is not equiv. to the CO formed. No CO is formed between 400° and 600°, and the only sign of action is an initial fall in pressure due to activated adsorption of CO_2. The formation of an activated complex (CO_2) is probably also responsible for the initial fall in pressure between 600° and 750°. The phenomena between 750° and 900° are considered as a superposition of (I) and of (CO) desorption, (CO) $\rightarrow$ CO. At room temp. only the process of a physical CO_2 adsorption has been observed, and its velocity is immeasurably high. Two schemes of the reaction mechanism satisfactorily explain the observed phenomena: (i) is based on the direct impact of activated CO_2 mols. on a C surface free from (CO_2) and (CO), and (ii) that the first step of the reaction is the activated CO_2 adsorption followed by the reaction of chemisorbed (CO_2) with a surface free from (CO). W. R. A.

Heterogeneous reaction between chromic sulphate and manganese dioxide. M. PRASAD, M. A. NAQVI, and V. N. SHETGIRI (Current Sci., 1939, **8**, 361—362).—In aq. solution, $2Cr^{\cdot\cdot\cdot} + 3MnO_2$ (solid) $+ H_2O = 3Mn^{\cdot\cdot} + Cr_2O_7'' + 2H^{\cdot}$. The rate increases with the MnO_2 surface, with [$Cr^{\cdot\cdot\cdot}$], and with the p_H. The relation between the unimol. k and the reaction velocity is linear and independent of the MnO_2 surface. L. J. J.

Viscosity effect on the rate of dissolution of calcium carbonate in hydrochloric acid. H. TOMINAGA, H. ADZUMI, and T. ISOBE (Bull. Chem. Soc. Japan, 1939, **14**, 348—352).—The effects of varying η (by addition of glycerol) and the speed of rotation (v), on the rate of dissolution of a rotating marble disc in HCl, have been studied. The rates of diffusion and of chemical reaction are of the same order of magnitude. After a short induction period the rate is unimol. with respect to HCl, and k^{-1} is a linear function of η and v^{-1}. The temp. coeff. and energy of activation, corr. for η effect, are 1·82 for 20°, and 5400 g.-cal. F. J. G.

Structural faults in solids, investigated for the oxides of manganese by Hahn's emanation method. R. JAGITSCH (Z. physikal. Chem., 1939, **B**, **44**, 209—215).—MnO_2 containing Ra-Th, pptd. by aq. NH_3 and Br–H_2O, was heated at 1050° in N_2 + 10% of O_2 to yield Mn_3O_4, and the variation of the emanating power (E) of the product with temp. studied. The curve of $\log (E - E_0)$ against $1/T$ shows breaks at 686° and 800°, which are interpreted as indicating false structural changes at these temp. with consequent changes in the ease of diffusion of the radioactive atoms. According to Tammann's relation these indicate m.p. 1570° and 1790°, in accord with the observed m.p. 1560° and 1785° for Mn_3O_4 and MnO, respectively. In presence of MnO_2 a change in the slope of the curve is observed at $\sim$280°, and E attains a max. at $\sim$400°, where the velocity of decomp. is a max. and consequently max. disorder in the crystal lattice is observed. When Mn_2O_3 is heated in O_2, however, E attains a max. asymptotically at $\sim$520°. From the course of the curve it is deduced that the dissociation of MnO_2 into Mn_2O_3 and O_2 is accompanied by the absorption of 25·3 kg.-cal. per g.-mol. J. W. S.

Oxidation of solutions of ferrous salts. J. R. POUND (J. Physical Chem., 1939, **43**, 955—967).—Data for the oxidation of several Fe^{II} salts in presence

of weak and strong acids and mixtures thereof are recorded. Although, in general, acids in fairly high concn. increase the rate of oxidation and the Fe^{II} salts of weak acids are more rapidly oxidised than those of strong acids, no single explanation will account for all the data. High oxidation rates are caused by sp. catalysts, *e.g.*, H_3PO_4, oxidisers, and Pt-black. The rate of oxidation $\propto$ Fe^{II} salt concn. and depends on $[H^{\cdot}]$ in very dil. acid solutions, but in conc. acid and in EtOH solutions $[H^{\cdot}]$ plays an insignificant rôle. Oxidation is almost unaffected by neutral salts although large quantities of chloride increase the rate. Citric acid and to a smaller extent $H_2C_2O_4$ reduce and increase oxidation in presence and in absence of light respectively. C. R. H.

Reaction velocities at low temperatures. II. Bromination of acetone between −40° and 10°. R. P. BELL and J. K. THOMAS (J.C.S., 1939, 1573—1578; cf. A., 1940, I, 40).—The reaction between Br and $COMe_2$ has been studied in 90·9% and 95% aq. $COMe_2$ between −40° and 10°. With HCl as catalyst the rate increases more rapidly than [HCl], suggesting that the acid is incompletely dissociated, and that the undissociated HCl is a more powerful catalyst than $OH_3^{\cdot}$. With HBr the rate approx. $\propto$ [HBr], a small residual dependence of (rate/concn.) on concn. being attributed to salt effect. The rates extrapolated to infinite dilution obey the Arrhenius equation, with $E = 19{,}900$ and 22,000 g.-cal. in 90·9% and 95% $COMe_2$, respectively. There are thus no indications of "tunnelling" effects. F. J. G.

Acid and base catalysis in light and heavy water. III. Bromination of acetone, catalysed by undissociated acids and by acetate ions. O. REITZ and J. KOPP (Z. physikal. Chem., 1939, **184**, 429—445; cf. A., 1939, I, 206).—The velocity of bromination of $COMe_2$ which is catalysed by undissociated acids (monochloroacetic, glycollic, lactic, acetic) in D_2O is ~20—30% > in H_2O, and is therefor different from the bromination catalysed by $H^{\cdot}$, which is twice as fast in D_2O as in H_2O. The bromination of $CO(CD_3)_2$ is slower than that of $COMe_2$ by a factor of 7·7, which is independent of whether the reaction is catalysed by $H^{\cdot}$, by undissociated acids, or by OAc′. The bromination of $COMe_2$ catalysed by OAc′ proceeds about 15% more slowly in D_2O than in H_2O. The mechanism of the reactions is discussed. The velocity measurements were carried out at 25° by following the varation of light absorption of Br_2 at 4316 A. with time. O. J. W.

Acid catalysis in non-aqueous solvents. VIII. Rearrangement of *N*-chloroacetanilide in chlorobenzene solution at 100°. R. P. BELL and P. V. DANCKWERTS (J.C.S., 1939, 1774—1776).—The transformation of *N*-NClPhAc into *o*- and *p*-$C_6H_4Cl·NHAc$ is catalysed by carboxylic acids at 100° in PhCl solution. The reaction coeff. increases with increase in the dissociation const. of the acid. The reaction is autocatalytic and it is suggested that traces of HCl, a very active catalyst, are formed as the result of NClPhAc + $C_6H_4Cl·NHAc$ → $NPhAc·NAc·C_6H_4Cl$ + HCl, this reaction being itself catalysed by acids. C. R. H.

Acid–base catalysis in the depolymerisation of dimeric glycollaldehyde. R. P. BELL and J. P. H. HIRST (J.C.S., 1939, 1777—1780).—The depolymerisation of dimeric glycollaldehyde (I) catalysed by acids and bases is quantitatively similar to the conversion of dimeric dihydroxyacetone (II) into the monomeric form (cf. A., 1938, I, 88). (I) is more sensitive to acids and less sensitive to bases than is (II). A new form of micro-dilatometer which operates with ~1 c.c. of liquid and is suitable for vol. changes of 0·2 cu. mm. is described. C. R. H.

Mechanism of decomposition of hydrogen peroxide by catalase. D. KEILIN and E. F. HARTREE (Nature, 1939, **144**, 787—788; cf. A., 1938, I, 148).—Evidence for the view that the decomp. of H_2O_2 by catalase is due to the successive reduction of the catalase Fe by H_2O_2 and its re-oxidation by O_2 is summarised. The experiments of Johnson *et al.* (A., 1939, I, 617) are criticised. L. S. T.

Activation entropy in catalytic mechanisms. A. E. STEARN, H. P. JOHNSTON, and C. R. CLARK (J. Chem. Physics, 1939, **7**, 970—971).—Theoretical. L. J. J.

Reaction velocity of hydrogen and oxygen at the surface of platinum catalyst. E. F. M. VAN DER HELD and H. P. REINDL (Physica, 1939, **6**, 997—1008).—The rate of combination of H_2 and O_2 at the surface of a Pt wire in presence of excess of N_2 $\propto$ $[H_2]$ and $[O_2]^{\frac{1}{2}}$. L. J. J.

Relative effect of inhibitants on adsorption and on catalytic activity. II. E. B. MAXTED and H. C. EVANS (J.C.S., 1939, 1750—1754).—An extension of investigations on the poisoning of Pt by H_2S (A., 1938, I, 569). The correspondence between the slopes of the catalytic activity–H_2S and H_2 adsorption –H_2S graphs holds also for the later stages of poisoning. C. R. H.

Exchange reactions of nitrogen isotopes on iron and tungsten surfaces. G. G. JORIS and H. S. TAYLOR (J. Chem. Physics, 1939, **7**, 893—898).—The reaction $^{28}N_2 + {}^{30}N_2 = 2{}^{29}N_2$ has been followed mass-spectrographically on the surface of $Fe–K_2O–Al_2O_3$ and $Fe_3O_4–Al_2O_3$ synthetic NH_3 catalysts at 450°—725° and on W at 700—900°. The N exchange reaction, unlike H exchange, is not measurable below 450°. H_2 accelerates the reaction. The temp. coeff. corresponds with an activation energy of ~50 kg.-cal. True activated adsorption of N_2, and either rupture of valency bonds of adsorbed N_2 or migration of N atoms over the surface, are involved in the reactions. L. J. J.

Catalytic oxidation with manganese dioxide. VI. Effect of water vapour on the kinetics [of oxidation of carbon monoxide]. S. J. ELOVITSCH and V. A. KORNDORF. **VIII. Kinetics of oxidation of carbon monoxide at low pressures.** S. J. ELOVITSCH and L. A. KATSCHUR (J. Gen. Chem. Russ., 1939, **9**, 673—681, 714—728; cf. A., 1938, I, 629).—VI. The catalytic oxidation (MnO_2) of CO by O_2 is unaffected by presence of CO_2. At low pressures (0·1 mm.) both oxidation of CO and its adsorption by the catalyst take place, the latter process being favoured by presence of H_2O.

VIII. The velocity of the catalytic reaction $\propto$ [CO], but not as the $[O_2]$ of the reaction mixture; it is represented by $dq/dt = ae^{-\alpha q}$, where q is the amount of CO reacted at time t, and a and α are consts. At very low pressures (0·002—0·1 mm.) the same expression applies to the process of chemisorption. Drying the catalyst at 180° enhances the heterogeneity of its surface. The processes are represented: $CO + MnO_2 \rightarrow MnO_2,CO$ (activated adsorption); $MnO_2,CO + O_2 \rightarrow MnO_2,O + CO_2$ (catalysis); $MnO_2,CO \rightarrow MnO + CO_2$ (chemisorption); $MnO_2,O + CO \rightarrow MnO_2 + CO_2$. R. T.

Contact sulphuric acid manufacture. XVI—XVIII.—See B., 1939, 1233.

Influence of certain salts on the lowest temperature at which a reaction between methane and oxygen is observed. W. P. JORISSEN and H. O. LEBBINK (Rec. trav. chim., 1939, **58**, 959—963).—The min. temp. for combustion of CH_4 in a Supremax glass tube was 250°, and was lowered to 150° by treating the tube with HF. Coating the tube with alkali halides raised the min. temp., the effect increasing in the order F < Cl < Br < I and Li < Na < K < Rb. With KI the min. temp. was 540°. F. J. G.

Catalytic effect of metal on paraffin hydrocarbons.—See B., 1939, 1208.

Catalysts for synthesis of liquid hydrocarbons from carbon monoxide and hydrogen.—See B., 1939, 1208.

Catalytic investigations on alloys. V. Catalytic hydrogenation of ethylene on copper–nickel alloys. G. RIENÄCKER and E. A. BOMMER (Z. anorg. Chem., 1939, **242**, 302—312; cf. A., 1938, I, 259).—Cu and Cu-rich alloys show a low, Ni and Ni-rich alloys a high, activity in catalysing the reaction $C_2H_4 + H_2 = C_2H_6$. The activity increases very markedly with alloys containing 19·2—19·8 at.-% Ni, which is approx. the composition at which the colour of the alloys changes from red to white. The activity of alloys containing 20—80% Ni is > that of the components, and the activation energy increases up to 25 kg.-cal., whereas the activation energies of Cu and Ni are 19·5 and 5 kg.-cal., respectively. O. J. W.

Catalytic oxidation of olefinic hydrocarbons.—See B., 1939, 1208.

Hydrogenation of *cyclo*hexene with copper catalysts. S. TSUTSUMI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 360—362).—*cyclo*-Hexene can be hydrogenated with Cu-kieselguhr catalysts at 110—210°. The optimum reaction temp. is 170°. Al_2O_3, ThO_2, and Cr_2O_3 are effective promoters. L. J. J.

Differences between the catalytic actions of cobalt, palladium, and platinum catalysts. S. TSUTSUMI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 352—359).—Activities of Co–, Pd–, and Pt–kieselguhr catalysts with varying metal–kieselguhr ratios have been compared for the hydrogenation of C_6H_6 (I) at 300—500°, 110—250°, and 110—190°, respectively, hydrogenation of *cyclo*hexene (II) at 110—250°, 110—190°, and 110—190°, respectively, and dehydrogenation of *cyclo*hexane (III) at 300—450°, 250—450°, and 250—450°, respectively. For the Co catalysts the optimum proportion of kieselguhr decreased in the order (I) → (II) → (III), for the Pd and Pt catalysts in the order (II) → (III) → (I). L. J. J.

Velocity of hydrogenation of aromatic hydrocarbons. III. [Dependence of] velocity of reaction on structure. A. V. LOZOVOI and M. K. DJAKOVA (J. Gen. Chem. Russ., 1939, **9**, 895—904; cf. A., 1938, I, 317).—The velocity of catalytic hydrogenation ($Ni-Al_2O_3$) of C_6H_6 derivatives is given approx. by $V_n = 2^{-n}V$, where V is the val. for C_6H_6 and n is the no. of substituents. The nature of the substituent does not appreciably affect the result. R. T.

Catalysts prepared by thermal decomposition of metallic compounds in an oily medium. II. Nickel formate.—See B., 1939, 1258.

Catalytic action of silver. D. DINELLI (Annali Chim. Appl., 1939, **29**, 448—451).—CuO, pptd. by NaOH from aq. $CuSO_4$ containing small amounts of $AgNO_3$, is as effective in the catalysis of the oxidation of aldehydes (*e.g.*, furfuraldehyde, PhCHO, and furylacrylaldehyde) to the corresponding acids as is pure, freshly pptd. Ag_2O. F. O. H.

Free diffusion of discharged ions in electrode processes. I. Formation of hydrogen peroxide and oxygen at the anode. G. HEINRICH and A. KLEMENC (Z. physikal. Chem., 1939, **184**, 347—366).—On the assumption that in the electrolysis of aq. solutions the primary reaction of the discharged OH′ ions consists of $2OH \rightleftharpoons H_2O_2$, a theoretical calculation is made of the likely $[H_2O_2]$ in the solution at different time intervals and at different distances from the anode. The results indicate that it would be difficult to confirm experimentally the anodic formation of H_2O_2. Further calculations also suggest that it would be impossible to obtain evidence for the formation of H_2O_2 from a comparison of the Faraday equiv. of the H_2 and O_2 evolved at the cathode and anode, respectively. O. J. W.

Electrolysis of fused potassium cyanate. A. PERRET and J. RIETHMANN (Compt. rend., 1939, **209**, 595—597).—The products of electrolysis of KCNO at 340° are: at the cathode, KCN (0·5 g.-mol. per faraday), K_2NCN, and K_2CO_3, produced by secondary reactions of K and K_2O with the KCNO; at the C anode, $KN(CN)_2$, $[KN(CN)_2]_3$, CO_2, and N_2 formed in a depolarisation reaction of CNO with KCNO, and traces of CO from decomp. of CNO. A. J. E. W.

Mechanism of corrosion of copper in electrolysis. N. D. TOMASCHOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 649—652).—The Cu–Pt couple in 3% aq. NaCl acts only in presence of an oxidising agent (*e.g.*, H_2O_2) at the cathode of the couple, Pt. Addition of H_2O_2 to the Pt compartment shifts the Pt potential in the positive direction to such an extent that dissolution of the Cu in the local element becomes possible. The dissolution of Cu in the couple Cu|0·1N-$(NH_4)_2SO_4$|Pt occurs when $(NH_4)_2S_2O_8$ is added to the Pt compartment. Similar results have been obtained with the couple Cu–Pt in HNO_3 and

H_2SO_4. These data indicate that the explanation of the mechanism of the dissolution of Cu (and other noble metals) based on a preliminary oxidation is not correct, and that the usual electrochemical theory of corrosion, after a detailed treatment of the processes of cathodic depolarisation, is in more complete agreement with the experimental data. W. R. A.

Effect of the nature of the solvent on the process of electrocrystallisation of silver. E. S. SARKISOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 679—682).—Using 0·25N-$AgNO_3$ in H_2O, MeOH, EtOH, and C_5H_5N, the change in the no. of Ag crystal centres forming on a Pt cathode during electrocrystallisation has been investigated. The product of the no. of centres and the dielectric const. of the solvent, for all except C_5H_5N, is const. The great affinity of C_5H_5N for $AgNO_3$ mols. explains the observed deviation from regularity for C_5H_5N solutions. W. R. A.

Electrolytic surface protection of metals.—See B., 1939, 1252.

Electrochemical study of corrosion of metals.—See B., 1939, 1248.

Effect of cathodic reactions on corrosion of metals from the viewpoint of the local cell theory.—See B., 1939, 1248.

Electrodeposition of synthetic resins.—See B., 1939, 1262.

Chemical action of electric discharges. XVIII. Production of nitric oxide by means of the high-frequency arc. Corrections and new results. E. BRINER, J. DESBAILLETS, F. RICHARD, and H. PAILLARD (Helv. Chim. Acta, 1939, **22**, 1096—1107; cf. A., 1936, 1348).—The work previously reported was based on faulty methods of analysis, and has been repeated using improved methods. The conclusions are qualitatively unchanged, but the yields of HNO_3 are < reported formerly. F. J. G.

Photosensitisation by means of solid substances: titanium dioxide. Photosensitised oxidation of ammonia in aqueous solution. I. G. G. RAO (Z. physikal. Chem., 1939, **184**, 377—384).—The ultra-violet photochemical oxidation of NH_3 to HNO_2 in aq. solution containing air is strongly accelerated by TiO_2, which also sensitises the reaction in the violet, blue, and green regions. Reaction velocity and light absorption measurements indicate that the adsorption layer on the TiO_2 is the seat of absorption and reaction, for which the following scheme is given: (1) $TiO_2 + h\nu \rightarrow TiO_2^*$, (2) $3TiO_2^* + NH_3 \rightarrow HNO_2 + H_2O + 3TiO$, (3) $6TiO + 3O_2 = 6TiO_2$ (rapid dark reaction). O. J. W.

Comparative investigations of the decomposition of azomethane by X-radiation and by light. P. GÜNTHER and F. GEBERT (Z. physikal. Chem., 1939, **B**, **44**, 203—208).—Study of the action of X-rays on mixtures of Me_2N_2 with Xe confirm that the yield per ion pair decreases when the ratio Xe : Me_2N_2 is >3 : 1 (cf. A., 1938, I, 408). When this ratio is <3 : 1 the yield $\propto$ the partial pressure of Xe. In decomp. by ultra-violet light under similar conditions the rate of decomp. is independent of the [Xe] over wide concn. ranges and $\propto$ the partial pressure of Me_2N_2. J. W. S.

Photochemical oxidation of chloral sensitised by chlorine. W. A. ALEXANDER and H. J. SCHUMACHER (Z. physikal. Chem., 1939, **B**, **44**, 313—326).—The velocity of the homogeneous oxidation of $CCl_3{\cdot}CHO$ is $\propto$ light intensity but is independent of the total pressure or of the pressures of the resulting products. Except at very low pressures (<2—3 mm. of Hg) the velocity is also independent of the pressures of $CCl_3{\cdot}CHO$ and O_2. A reaction scheme is proposed involving the formation of a peroxide, $CCl_3{\cdot}CO{\cdot}O_2$, which decomposes into $COCl_2$, CO, and ClO. ClO then reacts with another mol. of $CCl_3{\cdot}CHO$ to form $COCl_2$, CO, HCl, and Cl. The temp. coeff. for a rise of 10° is 1·14, and the quantum yield is 3000 mol. per $h\nu$. C. R. H.

Photochemical reaction between chlorine and chloral. W. A. ALEXANDER and H. J. SCHUMACHER (Z. physikal. Chem., 1939, **B**, **44**, 57—68).—The photochemical reaction between Cl_2 and $CCl_3{\cdot}CHO$ has been studied at 70—90°. It accords approx. with: $CCl_3{\cdot}CHO + Cl_2 + h\nu = CCl_4 + CO + HCl$, and the rate is given by $-d[Cl_2]/dt = k[I_{abs}]^{\frac{1}{2}}[Cl_2]$, with a temp. coeff. = 1·24 for 10°. The quantum yield, at 90° and for $p_{Cl_2} \sim 100$ mm., is ~ 800. The results are interpreted by the following chain mechanism: (1) $Cl_2 + h\nu = 2Cl$; (2) $Cl + CCl_3{\cdot}CHO = CCl_3{\cdot}CO + HCl$; (3) $CCl_3{\cdot}CO + Cl_2 = CCl_4 + CO + Cl$; (4) $2CCl_3{\cdot}CO = C_2Cl_6 + 2CO$ (chain-breaking). Formation of $COCl_2$ is negligible. F. J. G.

Photolysis of azomethane and of azomethane–acetaldehyde mixtures. F. E. BLACET and A. TAUROG (J. Amer. Chem. Soc., 1939, **61**, 3024—3027).—The photodecomp. of Me_2N_2 on irradiation with 3660 A. proceeds with a quantum yield of unity when calc. from the no. of mols. of free N_2 formed per quantum absorbed, and $\sim$0·75 when calc. from the pressure change in the reaction system. The former val. is considered more trustworthy. The removal of Te mirrors in a Paneth experiment indicates the formation of free radicals. A mechanism for the decomp. which accounts for all the gaseous products (1·9% H_2, 6·5% CH_4, 37% C_2H_6, 54% N_2) except the H_2 is suggested. From the detection of CO, Me_2N_2 photosensitises the decomp. of MeCHO by 3660 A. when the ratio MeCHO/Me_2N_2 is >10, the initial stage probably being $Me + MeCHO \rightarrow CH_4 + MeCO$. W. R. A.

Quantum yields and kinetics of a photosensitised production of reducing sugars from sucrose in aqueous solutions of uranyl sulphate by visible and ultra-violet light. L. J. HEIDT (J. Amer. Chem. Soc., 1939, **61**, 3223—3229).—Aq. solutions are transparent in the visible and near ultra-violet up to 2000 A., and the sucrose is therefore stable to light in this region. When UO_2SO_4 is added to the solutions, however, the $UO_2^{\cdot\cdot}$ ions absorb the visible and ultra-violet light and photosensitise the decomp. of sucrose with production of reducing sugars. The resulting decrease in optical activity $\simeq$ the amount of reducing sugars, determined as invert sugar by the Shaffer–Hartmann–Somogyi reagent. An expression is given for the variation of the quantum yield, ϕ, calc.

as the mols. of sucrose decomposed per photon absorbed by the system, with sucrose concn. For acetate-buffered solutions ϕ is independent of the light intensity, temp. (10—35°), p_H (3—6), and $[UO_2SO_4]$ between 0·0008M. and 0·008M. The kinetics of the reaction are discussed. W. R. A.

Auto-oxidation of aromatic amines. I—III. N. N. Voroshcov and A. A. Strelzova (J. Gen. Chem. Russ., 1939, **9**, 1015—1021, 1022—1035, 1036—1042).—I. The prep. of pure NH_2Ph and an apparatus for measuring the absorption of O_2 by NH_2Ph are described.

II. NH_2Ph absorbs practically no O_2 in darkness or in daylight, but much in ultra-violet light. The absorption is accelerated by aminothiophen or p-$C_6H_4(NH_2)_2$, retarded by thiophen, $H_2C_2O_4$, or o-$CO_2H{\cdot}C_6H_4{\cdot}S{\cdot}CH_2{\cdot}CO_2H$, and slightly retarded by Me_2S, Et_2S, or $CS(NHPh)_2$. In ultra-violet light $NPhMe_2$ absorbs O_2 more rapidly than does NH_2Ph, but does not take up N_2 or H_2.

III. The absorption of O_2 by NH_2Ph is accelerated by FeS pptd. from solution and slightly retarded by FeS prepared from Fe and S; in the latter case the NH_2Ph becomes dark exceptionally quickly. The absorption is strongly retarded by $Na_2S_2O_3$ and by commercial (not by recryst.) $Na_2S_2O_4$. J. J. B.

Decomposition of iron nitrides by bombardment with slow electrons. N. I. Nekrassov, A. V. Bondarenko, and P. M. Maltzeva (J. Phys. Chem. Russ., 1939, **13**, 56—70).—The "ϵ phase" of composition between Fe_3N and Fe_2N was bombarded with electrons and the increase of the gas pressure observed. The yield of gas per electron increased from 0·005 mol. at 4 v. to 1·2 mol. at 120 v.; sharp increases took place at 7, 10, and 17 v. These potentials are supposed to be the crit. potentials of Fe nitride and to correspond with a liberation of N in 3 different forms. The rate of decomp. of the nitride was almost const. J. J. B.

Rupture of macro-molecules by ultrasonic waves. G. Schmid and O. Rommel (Z. physikal. Chem., 1939, **185**, 97—139).—A detailed account of work already noted (A., 1939, I, 621).

Separation of liquid mixtures by the Clusius separation tube method. H. Korsching and K. Wirtz (Z. Elektrochem., 1939, **45**, 662—663).—Previous experiments (A., 1939, I, 483) are discussed. Separation of Zn isotopes is not conclusively proved. A. J. E. W.

Reaction of gallium with perchloric acid and the preparation and properties of gallium perchlorate hydrates. L. S. Foster (J. Amer. Chem. Soc., 1939, **61**, 3122—3124).—Ga dissolves readily in hot 72% $HClO_4$ (*a*) but more rapidly in a 2 : 1 mixture of 98% H_2SO_4 and 72% $HClO_4$. The sol. form of Ga_2O_3 dissolves in $HClO_4$ (*b*) but the insol. form does not react with $HClO_4$ unless it is first dissolved in HCl and the excess of HCl expelled by $HClO_4$. $Ga(ClO_4)_3,6H_2O$ (I), formed by (*a*) and (*b*), is very deliquescent, and very sol. in H_2O, EtOH, and AcOH; by slow evaporation from warm aq. $HClO_4$ it is deposited as isotropic regular octahedra. It is decomposed at 175° to basic Ga perchlorate of indefinite composition and at $>$175° to insol. Ga_2O_3. When conc. aq. (I), containing only a trace of free $HClO_4$, was allowed to evaporate in a vac. desiccator over conc. H_2SO_4 very large crystals of $Ga(ClO_4)_3,9{\cdot}5H_2O$ (II) were formed. (II) is very slowly converted into (I) at 120°. W. R. A.

Concentration of heavy carbon by thermal diffusion. W. W. Watson (Physical Rev., 1939, [ii], **56**, 703; cf. Furry, A., 1939, I, 395).—The experiments described, using apparatus based on theoretical considerations, for the concn. of ^{13}C by diffusion of CH_4 gave a max. $^{13}C/^{12}C$ ratio of 2·02%, in agreement with the results of Bramley (cf. *ibid.*, 483), but contrasted with the five- or six-fold concn. predicted by theory. N. M. B.

Precipitates obtained by adding sodium silicate to magnesium sulphate. R. Roseman, M. B. Levin, and H. Eisenberg (Amer. J. Pharm., 1939, **111**, 400—406).—The prep. of a series of Mg silicates by interaction of Na silicate and $MgSO_4$, where the ratio $Na_2O,3{\cdot}27SiO_2 : MgSO_4,7H_2O$ varies from 0·51 to 2·03, is described. The products have a ratio $MgO : SiO_2$ of 1 : 3·08 to 4·31. With increasing ratios of amounts of reactants the products have increased SiO_2 and decreased MgO contents. A synthetic Mg silicate in which the mol. ratio $MgO : SiO_2$ is the same as the mol. ratio $Na_2O : SiO_2$ in the Na silicate used (1 : 3·27) is obtained by interaction of equal nos. of mols. of silicate and sulphate. J. N. A.

Crystallographic investigation of artificial mullite. D. P. Grigoriev and I. I. Schafranovski (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 933—934).—Goniometric data in agreement with those of Bowen and Greig (A., 1924, ii, 488) are recorded for mullite crystals. The crystals examined showed the planes *a* (100) and *b* (010). L. J. J.

Germanium phosphide. M. Zumbusch, M. Heimbrecht, and W. Biltz (Z. anorg. Chem., 1939, **242**, 237—248).—By heating mixtures of Ge and P (Ge : P = 1 : 4) in evacuated sealed tubes above 550° products containing $\not>$1·68 P for 1 Ge were obtained. *X*-Ray and tensiometric measurements show that the solid product is a two-phase system of Ge and GeP. The *d* and mol. vol. of various products and the following thermal data are given: 4GeP (solid) = 4Ge (solid) + P_4 (gas) − 37 kg.-cal. at 540°; Ge (solid) + P (white) = GeP (solid) + 6 kg.-cal. Experiments on the volatility of Ge and on the analysis of Ge–P preps. are described. O. J. W.

Zirconium sulphides. E. F. Strotzer and W. Biltz [with K. Meisel] (Z. anorg. Chem., 1939, **242**, 249—271).—The prep. of ZrS_2 and ZrS_3 by heating the elements together under pressure is described. Pure ZrS_2 can also be obtained by the action of H_2S on $ZrCl_4$, and ZrS_3 by treatment of ZrS_2 with S; ZrS_2 (solid) + S (rhomb.) = ZrS_3 (solid) + 8·5 kg.-cal. The system Zr–S has also been examined by means of *X*-ray and tensiometric technique, and evidence for the existence of lower sulphides has been obtained. *d* and mol. vol. vals. for various Zr–S preps. are given. ZrS_2 is salt-like in character. The behaviour of Zr sulphides in relation to the position of Zr in the periodic table is discussed. O. J. W.

Synthesis of tin hydride by the action of atomic hydrogen on tin chloride. V. M. Vdovenko (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 801—803).—At. H reduces $SnCl_2$ to Sn with intermediate formation of SnH_4. The addition of CH_4 to the at. H increases the yield of SnH_4. A. J. M.

Lead suboxide. L. L. Bircumshaw and I. Harris (J.C.S., 1939, 1637—1639).—In the decomp. of PbC_2O_4 the gases evolved are $2CO_2 + CO$ if pumped off continuously, but contain rather more CO_2 if they remain in the reaction vessel, owing to reduction of PbO by CO. *X*-Ray diagrams and measurements of electrical conductivity show that the residue contains Pb and PbO. The equation is $3PbC_2O_4 = 2PbO + Pb + 4CO_2 + 2CO$. F. J. G.

Phosphoryl bromofluorides. H. S. Booth and C. G. Seegmiller (J. Amer. Chem. Soc., 1939, **61**, 3120—3122).—Fluorination of $POBr_3$ at 25—50 mm. by SbF_3 yields POF_3 (60%), *phosphoryl monobromodifluoride*, POF_2Br (10%), and *phosphoryl monofluorodibromide*, $POFBr_2$ (30%) which were separated and purified by methods previously described (A., 1939, I, 622, 623). The f.p. and v.p. of POF_2Br and $POFBr_2$ are respectively: $-84{\cdot}8\pm0{\cdot}2°$, $-117{\cdot}2\pm0{\cdot}2°$; log $p = -1642{\cdot}9/T + 7{\cdot}1687$, $-1550{\cdot}0/T + 7{\cdot}9662$. W. R. A.

Removal of oxygen from gases with active copper. F. R. Meyer and G. Ronge (Angew. Chem., 1939, **52**, 637—638).—In the apparatus described the dried gases are passed down a column containing reduced Cu dispersed on a kieselguhr carrier and heated at 200°. As the Cu becomes oxidised a yellow separating band of Cu_2O travels down the column and acts as an indicator of the degree of exhaustion of the Cu. When two thirds of the Cu is consumed the metal is regenerated by passing H_2 through the column. The partial pressure of O_2 in the gas emerging from such a column is $<3 \times 10^{-4}$ mm. J. W. S.

Reactions of chromates at high temperatures. X. Decomposition of mixtures of calcium chromate with sodium carbonate and ferric oxide. D. S. Datar and S. K. K. Jatkar (J. Ind. Inst. Sci., 1939, **22**, **A** 225—236).—Mixtures of $2CaCrO_4 + Na_2CO_3$ afford on decomp. the *basic chromate*, $4Na_2O,8CaO,8CrO_3$ (I), further decomp. of which affords $4Na_2O,8CaO,6CrO_3,Cr_2O_3$ (II), $3Na_2O,6CaO,4CrO_3,Cr_2O_3$, and $5Na_2O,10CaO,6CrO_3,2Cr_2O_3$. From the decomp. pressures, the heats of decomp. are 14·9, 43·6, 24·4, and 37·4 kg.-cal. per mol. of O_2, respectively. (I) and (II) are notably stable. In the decomp. of mixtures of $CaCrO_4$ with Fe_2O_3 there are indications of the formation of a basic Fe chromate at 25% decomp. F. J. G.

Effect of hydrochloric acid concentration on the reduction of molybdate in the silver reductor. C. F. Hiskey, V. F. Springer, and V. W. Meloche (J. Amer. Chem. Soc., 1939, **61**, 3125—3127).—By means of the Ag reductor, MoO_4 is completely reduced to Mo^{V} in 2N-HCl (Birnbaum and Walden, A., 1938, I, 158). Traces of Mo^{III} may be formed but exposure to the air oxidises them to Mo^{V} before the sample is determined by titration against $Ce(SO_4)_2$, and the reduction is hence virtually a quant. reduction to Mo^{V}. With [HCl] $>$4N., MoO_4 is reduced mainly to Mo^{III}, and for $\sim$10N-HCl the reduction shows an apparent valency change as high as 3·1. Using the Jones reductor (Zn) in absence of an oxidising atm. the apparent change in valency is $\not>3$ even with 6N-HCl. W. R. A.

Effect of p_H in the co-precipitation and concentration of some radio-elements. M. Bachelet (Ann. Chim., 1939, [xi], **12**, 348—415).—The possibility of concentrating and separating certain radio-elements by co-pptn. under controlled p_H has been studied. Ppts. produced in U solutions by alkalis, F′, or C_2O_4'' are only slightly enriched in U-*X* put pptn. by H_3PO_4 at $p_H \sim 1$ affords a useful concn. It is possible to carry down U-*X* from U solutions on $Al(OH)_3$, but only under such conditions that the separation is of little use in practice. On the other hand, $Fe(OH)_3$ affords a good separation: to the conc. solution of $UO_2(NO_3)_2$, $Fe(NO_3)_3$ is added, and then NH_3 to $p_H \sim 3$; the solution is boiled and filtered, the ppt. dissolved in HCl, and the Fe pptd. by NH_4HS in presence of $(NH_4)_2CO_3$, when the U-*X* remains in solution. Ra-Ac is easily separated from Ac by co-pptn. on $Cu(OH)_2$, $Zn(OH)_2$, $Fe(OH)_3$, or $La(OH)_3$. The use of the last is convenient, and the La can subsequently be pptd. by $(NH_4)_2CO_3$ and NH_3, when Ra-Ac remains in solution. In the fractional pptn. of $La(OH)_3$ and $Ac(OH)_3$ the latter accumulates in the last fraction; the p_H for its pptn. is intermediate between those for $La(OH)_3$ and $Mn(OH)_2$. Pa is conc. in the first fractions of a ppt. of $Zr(OH)_4$, but not sufficiently so to afford a useful separation except from HF solutions. Other useful separations are pptn. with a suitable carrier by $(NH_4)_2CO_3$, when Pa is thrown down and Zr remains in solution, or by fractional pptn. with H_2O_2 or $(NH_4)_2HPO_4$, when Pa is conc. in the ppt. F. J. G.

Risk of accident with constant-boiling 72% perchloric acid. W. Dietz (Angew. Chem., 1939, **52**, 616—618).—Const.-b.p. (72%) $HClO_4$ can be used without danger in the absence of a combustible material, but a mixture of H_2 and $HClO_4$ vapours explodes at 400—405°, or at lower temp. in presence of a catalyst. During the dissolution of steel in $HClO_4$ a foam forms on the surface of the solution, and when heat was applied to disperse it explosion occurred through the evaporation of $HClO_4$ into the H_2 yielding a mixture which exploded under the action of catalytically active materials present. The formation of such a mixture is avoided by adding H_2O to lower the b.p. of the solution to 150—160°. J. W. S.

Separation of bromine isotopes by centrifugation. R. F. Humphreys (Physical Rev., 1939, [ii], **56**, 684—691).—The high centrifugal field gradients produced by a Beams-type ultracentrifuge are considered for a partial separation of relatively heavy isotopes. Approx. theory giving the change in abundance ratio for a given set of conditions for a mixture of two isotopes subjected to evaporative centrifuging is presented. Experiments on EtBr showed spectroscopically that ^{79}Br was enriched 11% relatively to ^{81}Br, in fair agreement with theory. N. M. B.

Working up of iodine residues. F. T. VAN VOORST (Chem. Weekblad, 1939, **36**, 754).—The solution containing I′ is treated with $CuSO_4$ and $NaHSO_3$ and the pptd. CuI (50 g.) collected, washed, dried, and treated with $K_2Cr_2O_7$ (35 g.), H_2SO_4 (100 c.c.), and H_2O (500 g.) in a 1-l. flask fitted with an air condenser and the I recovered by distillation.
S. C.

Existence of a higher iron phosphide. M. HEIMBRECHT and W. BILTZ (Z. anorg. Chem., 1939, **242**, 233—236).—By treatment of a Sn–Fe alloy (5% Fe) with P under pressure an unstable grey-black *phosphide*, $FeP_{2.57}$, is obtained; d_4^{25} 4·43. The *X*-ray diagram does not show any of the lines of FeP_2. No evidence of the existence of FeP_3 was obtained.
O. J. W.

Reaction $Co_3S_4 \rightleftharpoons 2CoS + CoS_2$. M. HEIMBRECHT and W. BILTZ [with K. MEISEL] (Z. anorg. Chem., 1939, **242**, 229—232).—Thermal and *X*-ray measurements show that Co_3S_4 decomposes according to the above reaction at ~680°.
O. J. W.

Aquation of carbonatopentamminocobaltic bromide. A. B. LAMB and R. G. STEVENS (J. Amer. Chem. Soc., 1939, **61**, 3229—3233).—The aquation of $[Co(NH_3)_5CO_3]Br_3$ (I), investigated by measuring the conductance of its dil. aq. solutions at 0° and 25°, takes place slowly, giving an equilibrium mixture of $[Co(NH_3)_5HCO_3]^{\cdot\cdot}$, $[Co(NH_3)_5H_2O]^{\cdot\cdot\cdot}$, and $[Co(NH_3)_5OH]^{\cdot\cdot}$ ions. The aquation of $[Co(NH_3)_5HCO_3]Br_2$ (II) is more rapid and equilibrium with the anation reaction is established at velocities which have been measured. The mechanism for the aquation of (I) involves the rapid, reversible addition of an $H^{\cdot}$, followed by the slow, reversible aquation of (II) thus: $[Co(NH_3)_5CO_3]^{\cdot\cdot\cdot} \rightleftharpoons [Co(NH_3)_5HCO_3]^{\cdot\cdot} \rightleftharpoons [Co(NH_3)_5H_2O]^{\cdot\cdot\cdot} \rightleftharpoons [Co(NH_3)_5OH]^{\cdot\cdot}$ (first and last fast, second slow).
W. R. A.

Complex halogen salts of tervalent rhodium. J. MEYER and H. KIENITZ (Z. anorg. Chem., 1939, **242**, 281—301; cf. A., 1937, I, 397).—The prep. of the following Rh^{III} compounds is described: $RhF_3,6H_2O$; M_3RhF_6 (M = K, Rb, Cs); $RhBr_3,2H_2O$; RhI_3, and a large no. of diazido- and triazido-*complex salts*. The conductivity, mol. wt., and absorption spectra of $RhCl_3$ in various solvents have been measured, and the constitution of these solutions is discussed.
O. J. W.

Oxidation of complex compounds of bivalent platinum with hydrogen peroxide. A. V. BABAEVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 653—657).—By the action of 30% H_2O_2 *cis*- and *trans*-$[(NH_3)_2PtCl_2]$ and *cis*-$[(NH_3)_2Pt(NO_2)_2]$ are oxidised to the corresponding hydroperoxides $[(NH_3)_2Pt(O_2H)_2X_2]$, which are converted into $[(NH_3)_2Pt(OH)_2X_2]$ by H_2O. Only $[(NH_3)_2Pt(OH)_2(NO_2)_2]$ is formed by the action of H_2O_2 on *trans*-$[(NH_3)_2Pt(NO_2)_2]$. H_2O_2 oxidises *cis*-$[(C_5H_5N)_2PtCl_2]$ to $[(C_5H_5N)_2Pt(OH)_2Cl_2]$ but has no effect on *trans*-$[(C_5H_5N)_2PtCl_2]$.
W. R. A.

Oxidation of complex compounds of platinum with hydrogen peroxide. A. V. BABAEVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 145—148).—K_2PtCl_4, when cooled with excess of 30% H_2O_2, gives $K_2[PtCl_4(OH)_2]$ (I) which with HCl yields either K_2PtCl_6, KCl, and $KH[PtCl_2(OH)_4]$ or $H_2[Pt(OH)_6]$. Hydrolysis of (I) gives $K[PtCl_3(OH)_2H_2O]$. $K_2Pt(NO_2)_4$ with 30% H_2O_2 yields $K_2[Pt(NO_2)_4(OH)_2]$ and $KH[Pt(NO_2)_3OH]$. $[(NH_3)_4Pt]Cl_2$ with 30% H_2O_2 gives a *compound* (Pt 51·60, N 15·00, total Cl 21·24, ionisable Cl 17·00%) whilst $[(NH_3)_4Pt](NO_3)_2$ gives $[(NH_3)_4Pt(OH)_2](NO_3)_2$. Oxidation of $[(NH_2OH)_4Pt](OH)_2$ with H_2O_2 yields pure $H_2[Pt(OH)_6]$.
F. R. G.

Determination of low concentrations of chloride ion. N. Z. KOTELKOV and K. P. KOTELKOVA (J. Appl. Chem. Russ., 1939, **12**, 1092—1096).—An equal vol. of 0·4% $AgNO_3$ in 0·05N-HNO_3 is added to the solution containing 0·000025—0·0005N-Cl′, and the turbidity due to AgCl formation is determined 1 hr. later, using the special photo-electric nephelometer described. For more dil. solutions an equal vol. of EtOH is first added.
R. T.

Volumetric determination of chlorate and bromate. C. MAHR and H. OHLE (Z. anal. Chem., 1939, **117**, 389—391).—For the determination of ClO_3' a mixture of 20 c.c. of (1 : 1) H_2SO_4, 5 c.c. of 1% KI, and 20—30 c.c. of 0·1N-$CS(NH_2)_2$ is slowly run into the solution containing ClO_3'. The mixture is warmed for 10—15 min. at 70°, cooled to 35°, and diluted to 80 c.c. after the addition of starch. The excess of $CS(NH_2)_2$ is titrated with either Br′–BrO_3' or 0·1N-$KMnO_4$. Solutions containing BrO_3' are allowed to react in the cold with the $CS(NH_2)_2$, KI, and H_2SO_4 mixture, and must be well shaken. Aq. $CS(NH_2)_2$ is determined by titration with $KMnO_4$ after addition of 20 c.c. of (1 : 1) H_2SO_4, 5 c.c. of 1% KI, dilution to 80—90 c.c., addition of starch, and warming to 35°. When a clear blue colour appears the solution is diluted to 250—300 c.c. with warm (35°) H_2O, and titrated to a light blue colour.
L. S. T.

Detection of chlorine.—See B., 1939, 1301.

Determination of dissolved oxygen [in water] in the field.—See B., 1939, 1303.

Critical investigation of the analysis of hyposulphite preparations. H. ZOCHER and H. SAECHTLING (Z. anal. Chem., 1939, **117**, 392—400).—Wollak's iodometric method (B., 1930, 417) has been critically investigated. Certain precautions necessary for obtaining satisfactory results are pointed out. The pptn. of Ag in ammoniacal solutions by S_2O_4'' and not by other ions containing S and O (A., 1906, ii, 578) is used as the basis of the method detailed for determining S_2O_4''. The pptd. Ag is weighed, or titrated with CNS′ after dissolution in HNO_3, or dissolved in 0·5N-I and KI. In the last case, AgI is pptd. by dilution with H_2O, and the excess of I found by titration with $Na_2S_2O_3$. Results obtained from hyposulphite (I) preps. by (i) the total consumption of I, (ii) titration with I of the CH_2O solution of (I), and (iii) the above method are trustworthy, but, owing to the instability of the preps., are subject to errors of ~0·5%. The indirect determination of impurities from these methods is necessarily inaccurate. The thiosulphate content of the preps. is usually small, and can be neglected in (ii).
L. S. T.

Use of base-exchange substances in analytical chemistry. II. O. SAMUELSON (Svensk Kem. Tidskr., 1939, **51**, 195—206; cf. A., 1939, I, 385).—The significance of the ion concns. in the solid org. base-exchanging material (organolyte) in the application of the base-exchange principle to analysis is discussed. For the determination of SO_4'' in $Al_2(SO_4)_3$ an aq. solution containing about 0·002 equiv. of SO_4'' is treated with 3·2—4 g. of the sulphonic organolyte and filtered, washed until the wash-H_2O is neutral, and the filtrate titrated with 0·1N-NaOH against Me-red. The organolyte is regenerated by treatment with 2N-H_2SO_4. Alkali metals (*R*) are determined in presence of vanadate by passing the test sample through an organolyte saturated with $NH_4^{\cdot}$ ions, when the $R^{\cdot}$ ions remain behind and the $NH_4^{\cdot}$ ions pass on with the anions of the test solution. The $R^{\cdot}$ ions are washed from the organolyte with excess of HCl and the solution is evaporated to decompose the NH_4Cl, the alkalis then being determined in the usual way. Since NH_4VO_3 is only slightly sol. very dil. solutions must be used. 5 g. of sulphonic acid organolyte with an exchange capacity of 0·0035 equiv. per g. are required per 0·002 equiv. of cations in the test portion. T. H. G.

Determining sulphur in mild steel.—See B., 1939, 1249.

Rapid micro-gas-analysis of noble gas–nitrogen mixtures. J. A. M. VAN LIEMPT and W. VAN WIJK (Rec. trav. chim., 1939, **58**, 964—972).—The % of N_2 in ≮1 c.c. of a mixture of N_2 and a noble gas can be determined in 10 min. with the apparatus described, the N_2 being absorbed by fused Li. F. J. G.

Colorimetric determination of ammonia with thymol–hypobromite reagent. P. A. HANSEN and V. NIELSEN (J. Biol. Chem., 1939, **131**, 309—315).—Quantities of 0·5—20 μg. of NH_3 per c.c. can be determined by the method described with a mean error of 1—2%. This method depends on the formation, by the reaction of NH_3 with thymol and NaOBr, of a coloured substance which is sol. in $Pr^{\beta}{}_2O$ giving a red solution which can be used for colorimetric determination (Pulfrich photometer). P. G. M.

Determination of nitrogen in rubber.—See B., 1939, 1268.

Determination and detection of small quantities of phosphorus by the quinine molybdate complex. J. A. STREET (J. Proc. Austral. Chem. Inst., 1939, **6**, 395—399).—The P as PO_4''' is pptd. by $(NH_4)_2MoO_4$ in presence of HNO_3 and quinine and the vol. of the ppt. is measured after centrifuging. 0·01 μg. in 1 drop can be readily detected. Chromates (but not $Cr^{\cdot\cdot\cdot}$), oxalates, tartrates, and silicates interfere. F. L. U.

Micro-determination of arsenic. P. KAMERMAN (J. S. African Chem. Inst., 1939, **22**, 63—67).—The delivery tube of an ordinary Marsh apparatus is bent downwards at right angles to dip into a mixture of 0·02N-$AgNO_3$ (1·5 ml.) and 1% aq. gum arabic (0·5 ml.), contained in a test-tube shielded from light by black paper. The As evolved from the Marsh apparatus as AsH_3 reduces the $AgNO_3$ yielding a Ag sol, the colour of which is measured in a Lovibond tintometer. The method is suitable for determining 2—20 × 10^{-9} g. of As. J. W. S.

Determination of arsenic by the distillation method. D. R. JACKSON (J. S. African Chem. Inst., 1939, **22**, 68—70).—In the determination of As by pptn. as As_2S_3, treatment of the ppt. with H_2SO_4, and subsequent distillation with HCl to remove the As as $AsCl_3$, the results are 14—30% low owing to loss of $AsCl_3$ during the addition of HCl. Correct results are obtained if the treatment with H_2SO_4 is eliminated, or if the HCl is added through a tap funnel after the H_2O trap is placed in position. J. W. S.

Reaction between arsenite and permanganate solutions. E. CRIMMINS and J. R. POUND (Chem. Eng. Min. Rev., 1939, **31**, 457—460).—Stoicheiometric titration of $KMnO_4$ with $NaAsO_2$ in H_2SO_4 solution is obtained only in the presence of a catalyst; suitable catalysts are OsO_4 or KIO_3 (1 mg.) or HCl plus I. Good results are also obtained by titrating to the apparent end-point, adding a small vol. of standard $FeSO_4$, and completing the titration with $KMnO_4$, allowance being made for the $FeSO_4$. A. R. P.

Determination of arsenic in soil treated with acid lead arsenate.—See B., 1939, 1277.

Volumetric adsorptional method of determining calcium. N. A. FREZE (J. Appl. Chem. Russ., 1939, **12**, 949—950).—0·1N-$Na_2C_2O_4$ is added to the neutral solution, and excess of $Na_2C_2O_4$ is titrated hæmatein indicator) with 0·1N-$Ca(NO_3)_2$, to disappearance of the red colour. R. T.

Copper sulphate as a titrimetric standard substance. N. SCHOORL (Pharm. Weekblad, 1939, **76**, 1441—1446).—$CuSO_4,5H_2O$ is crystallised from a solution which has been treated with H_2O_2 and a small amount of alkali to remove $Fe(OH)_3$, and heated to 105° to form $CuSO_4,H_2O$; the latter is re-hydrated by keeping for 24 hr. in a desiccator over 13% H_2SO_4. The iodometric titration is carried out as described by Foote (A., 1938, I, 413). S. C.

Direct determination of alumina in certain silicates. E. W. KOENIG (Ind. Eng. Chem. [Anal.], 1939, **11**, 532—535).—The sample (10—30 mg. of Al_2O_3) is gradually heated to 400—500° in a Ni beaker with ≮10 times its wt. of previously-fused NaOH. The solution of the fused mass is boiled to coagulate Ni, Fe, Zr, and Ti hydroxides, and filtered. The filtrate is treated with an AcOH solution of 8-hydroxyquinoline (I), and stirred until the ppt. is dissolved. HCl is added until the solution is acid. A green coloration of the ppt. formed temporarily during this stage indicates the presence of Fe^{III}, when NH_2OH,HCl must be added to reduce the Fe, and 2 : 2′-dipyridyl hydrochloride or *o*-phenanthroline hydrochloride to keep it in solution. The Al is pptd. as (I) compound by adding an excess of NH_4OAc. The determination is completed volumetrically with $KBrO_3$–KBr and an I–$Na_2S_2O_3$ titration. U and V, but not Mg, will be found with the Al_2O_3. The method is satisfactory for felspars, Cornish stone, lepidolite (II), china clay (III), beryl, nepheline

syenite, kyanite (IV), glass sand, flint, spodumene, amblygonite, and burnt refractories (V). Certain substances, particularly (II)—(V), require an abnormally high ratio of flux to sample in order to ensure complete decomp., and to prevent hydrolysis of the Na aluminate formed in the fusion. L. S. T.

Determination of manganese by means of 8-hydroxyquinoline in presence of magnesium. G. S. SMITH (Analyst, 1939, **64**, 787—791).—The method for Al (A., 1939, I, 578) is applied to the determination of Mn. Small amounts of Mg (0·1 g.) cause little interference but 0·1—0·5 g. cannot be separated with certainty unless the Mn pptn. is repeated. Several modifications of the procedure have been studied and one is recommended. E. C. B. S.

Volumetric analysis by means of thiocarbamide. II. Volumetric determination of manganese dioxide, lead dioxide, and per-compounds. C. MAHR and H. OHLE (Angew. Chem., 1939, **52**, 238; cf. A., 1939, I, 279).—For the determination of MnO_2 in pyrolusite 20—25 c.c. of 0·1N-$CS(NH_2)_2$ are mixed with 50% H_2SO_4 (25 c.c.), syrupy H_3PO_4 (5 c.c.), and 1% aq. KI (5 c.c.), and the solution is diluted to 75 c.c. 70—80 mg. of the sample are then added, and the mixture is heated at 70° for 10—15 min. to complete dissolution. After cooling to 35° starch is added, and the solution is titrated with 0·1N-Br′–BrO_3' solution. After the appearance of the blue colour the solution is diluted to 250—300 c.c. and the titration completed. PbO_2 can be determined by a similar method if H_2SO_4 and H_3PO_4 are replaced by 60% $HClO_4$ (15—20 c.c.). In the determination of BaO_2 they are replaced by conc. HCl (5 c.c.). H_2O_2, perborates, percarbonates, and persulphates can also be determined by this method if the heating is so modified as to ensure complete decomp. J. W. S.

Separation and colorimetric determination of rhenium and molybdenum. J. I. HOFFMAN and G. E. F. LUNDELL (J. Res. Nat. Bur. Stand., 1939, **23**, 497—508).—The solution containing Re and Mo in dil. HCl is treated with saturated aq. $KMnO_4$ to ensure that these elements are present as molybdate and perrhenate, respectively, and after addition of 10 mg. of Fe (as $FeCl_3$) the solution is extracted with Et_2O to separate the elements roughly into Mo (Et_2O-sol.) and Re (HCl-sol.) fractions. The separate fractions, in HCl solution, are shaken with Hg, KCNS, and Et_2O, when the Mo only is reduced to a form which yields a coloured, Et_2O-sol. compound with the KCNS, which permits the direct colorimetric determination of Mo. Addition of $SnCl_2$ to the aq. solution remaining after extraction of the Mo produces a yellowish-red Et_2O-sol. product which serves for the colorimetric determination of Re. The method permits the detection of 0·001 mg. of Re in 10 mg. of Mo, or of 0·01 mg. of Mo in 10 mg. of Re. Several metals interfere with the determination of Re, but these can be eliminated by distilling off the Re from a mixture of HCl and $HClO_4$. J. W. S.

Routine spectrographic analysis of iron and steel.—See B., 1939, 1245.

Polarographic determination of alloy additions in special steels.—See B., 1939, 1249.

Determination of chromium in pure aluminium.—See B., 1939, 1251.

Thiocyanate reaction of molybdenum. Y. UZUMASA and K. DOI (Bull. Chem. Soc. Japan, 1939, **14**, 337—343).—The production of a red colour by $SnCl_2$ and CNS′ in Mo solutions has been studied by photo-electric colorimetry and spectrographically. The colour intensity when CNS′ is added first is > when $SnCl_2$ is added first, and is a max. for [HCl] = 5—6%. The only effect of adding $COMe_2$ is to retard the fading caused by further reduction. The colour is probably due to CNS complexes of Mo^V and the effect of adding $SnCl_2$ first is probably the formation of Cl complexes which are only with difficulty converted into the coloured CNS complex. F. J. G.

Decomposition of cassiterite by fusion with borax and its chemical analysis. I. D. BORNEMAN-STARINKEVITSCH (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 353—356).—Complete analysis of cassiterite containing Si, Ti, Zr, Nb, Ta, Fe, and Mn is effected by fusion with borax, dissolution in H_2SO_4–HCl, reduction with Al, and iodometric titration of Sn. The remaining elements are determined after reduction with H_2 and extraction with HCl. L. J. J.

Detection and determination of germanium. I. New colour reaction. Application of hydrogen selenide to detection of germanium. V. I. KUZNETZOV (J. Gen. Chem. Russ., 1939, **9**, 1049—1054).—Se (20 g.) + NaCl (20 g.) + Al (14 g.) are gently heated. The Al_2Se_3 obtained is decomposed by H_2O, and the H_2Se is absorbed by CH_2O solution. 3 drops of the resulting solution are added to 5 c.c. of Ge solution + 1 c.c. of conc. HCl, when a yellow turbidity or a yellow ppt. is produced. When kept for 2 days the H_2Se–CH_2O solution becomes turbid also in the absence of Ge. J. J. B.

Determination of bismuth by the quinaldine salt of iodobismuthous acid. J. R. HAYES and G. C. CHANDLEE (Ind. Eng. Chem. [Anal.], 1939, **11**, 531—532).—The sample containing ~0·03 g. Bi is dissolved in H_2SO_4, the solution diluted, and the acidity adjusted to ~N. After adding aq. Na_2SO_3, Bi is pptd. by the addition of a solution containing quinaldine, KI, and conc. H_2SO_4. The red ppt. is washed first with a similar solution, and then with $COMe_2$ in $Bu^a{}_2O$ to remove I′ left by the first wash liquid. After dissolution of the ppt. in NaOH, and decomp. by boiling, the solution is acidified with HCl, and the I′ titrated to ICN by Lang's method. 1 ml. of 0·025M-KIO_3 is equiv. to 0·002612 g. of Bi. With samples of pure Bi the average error is 0·30%. With small amounts (~0·0003 g.) of Bi the I′ is titrated to ICl by Andrews' method. Slight modifications of the above procedure permit the determination of Bi in presence of Pb, Sb, Sn, Cd, Cu, Fe, Cr, Mn, Co, Ca, Ba, $UO_2^{\cdot\cdot}$, Ni, Be, Al, Ti, Zn, Na, K, AsO_4''', AsO_3''', and PO_4'''. High [Cl′] leads to low results, and the method cannot be used in presence of Hg or Ag. Acid concns. can vary from 2·5 to 10 vol.-% of H_2SO_4. L. S. T.

Instrument for the reproduction, regulation, and control of variable temperature. W. E. STONE (J. Washington Acad. Sci., 1939, **29**, 410—415). The construction, performance, and accuracy of an

instrument developed to permit laboratory reproduction of field-recorded temp. are described. Charts showing daily and weekly temp. records and the production of a gradually rising and falling as well as a const. temp. are reproduced. L. S. T.

Reaction velocities at low temperatures. I. Low-temperature thermostat. R. P. BELL and J. K. THOMAS (J.C.S., 1939, 1573—1575).—Apparatus based on that of Simon (A., 1927, 335; 1928, 1348) is described. F. J. G.

Vacuum adiabatic calorimeter. A. B. ADAMS, R. S. BROWN, W. H. BARNES, and O. MAASS (Canad. J. Res., 1939, **17**, **B**, 341—352).—The Pt container is heated by contact with the walls of a vertical brass tube which connects the calorimeter with the thermostat and projects into the latter. Hg is used as the calorimetric liquid and the container is drawn down into it by means of a system of strings and pulleys. The calorimeter and tube are evacuated and the temp. is measured by Cu–constantan thermocouples. T. H. G.

Precise method of measuring heat conductivity applicable to either molten or solid metals. Thermal conductivity of zinc. C. C. BIDWELL (Physical Rev., 1939, [ii], **56**, 594—598).—In the method described the test metal is packed in a hollow vertical graphite cylinder surrounded by silocel contained in an outer Fe cylinder. The principle of the method is that with a downward heat flow in the thermally insulated specimen the thermal gradient changes at const. rate down the rod, and in this case the radial heat loss across the insulation per cm. length is const. Results for solid and molten Zn up to 730° are reported and compared with available data. High superiority for the method is claimed. N. M. B.

Effective wave-length to be used in calibrating a disappearing-filament optical pyrometer. F. A. CUNNOLD (Phil. Mag., 1939, [vii], **28**, 588—591).—The effective λ to be used is that which is effective between the colour temp. of the pyrometer filament and the source. The brightness temp. measured with an instrument so calibrated are then independent of the optical properties of the source except in so far as its brightness temp. controls the brightness temp. and hence the colour of the filament for matching. T. H. G.

Spectrographic design and its problems. J. W. FORREST (Ind. Eng. Chem. [Anal.], 1939, **11**, 568—571). L. S. T.

Device for quantitative evaluation of spectral lines.—See A., 1939, III, 1095.

Monochromators and auxiliary apparatus. J. STRONG (Ind. Eng. Chem. [Anal.], 1939, **11**, 563—567).—The following are described and discussed: reflectivities of metals, *e.g.*, Ag, Al, stellite, and speculum, used for mirrors in instruments, double quartz monochromator for O_3 and H_2O determinations, optical materials for infra-red spectroscopy, radiation-receiving devices, etc. L. S. T.

Preparation of immersion liquids for the range n_D 1·411 to 1·785. E. P. KAISER and W. PARRISH (Ind. Eng. Chem. [Anal.], 1939, **11**, 560—562).—The prep. of liquids increasing in n by 0·005 unit over the range 1·411—1·785 is described. The end members of the series are n-$C_{10}H_{22}$, medium government (U.S.) oil, 1-$C_{10}H_7Cl$, CH_2I_2, and CH_2I_2 saturated with S. Standardisation, storage, and corrections to be applied to vals. of n are described. L. S. T.

Two graphical methods for the determination of optical data at given crystal faces. H. TERTSCH (Min. Petr. Mitt., 1939, **51**, 163—171; cf. Lane *et al.*, A., 1938, I, 537).—The Fresnel construction for the direction of the optical vibration in the surface of a biaxial crystal is applied. A nomogram is given by means of which the axial angle and extinction angle in the 010 face can be obtained from those in the 110 face. A. J. M.

Use of bimetallic strips in radiation measurement and photometry. H. KLUMB (Z. tech. Physik, 1936, **17**, 279—280; Chem. Zentr., 1937, i, 3186).—Two forms of apparatus are described in which movement of the bimetallic strip is magnified by a pointer and microscope. Readings are obtained in 20—30 sec., with a sensitivity of 10 ergs per sec. per scale division, and a reproducibility of 2—3%. A. J. E. W.

Ultrasonic stroboscope for measuring sound wave-lengths in liquids. F. E. FOX and G. D. ROCK (Rev. Sci. Instr., 1939, **10**, 345—348).—Light from a line source is modulated on crossing a sound beam and is then passed across a second sound beam which is to be studied stroboscopically. Plane mirrors are employed to use the modulated light for the stroboscopic study of the modulating sound beam. The resulting bands are observed directly or photographically. D. F. R.

Measurement of small optical activities with the quartz crystal light modulator. D. W. R. MCKINLEY (Canad. J. Res., 1939, **17**, **A**, 202—207).—The optimum light modulation effects that occur when light is passed through a vibrating quartz crystal in the direction of the optical axis are described and an elementary analysis of the crystal action is given. The technique has been applied to the measurement of very small optical rotations. The accuracy is ~10 sec. of arc, and the method is capable of still greater precision. O. J. W.

Apparatus for determining oxidation–reduction potentials in a vacuum. H. JØRGENSEN (Biochem. Z., 1939, **302**, 226—231).—In the apparatus, a KCl–Hg_2Cl_2 electrode is immersed in saturated aq. KCl in a tube having, at the lower end, a cap attached by means of a ground joint on which a thin film, renewed at each determination, of the solution is maintained. The tube, in an evacuated vessel, is immersed in the liquid (vol. ~60 c.c.) the potential of which is to be measured. Also immersed in the liquid are two other electrodes of heavy Au foil. The potentials of fruit juices containing polyphenol-oxidases (*e.g.*, pear, grape, apple) are > those of other juices (*e.g.*, lemon, cranberry, spinach). W. McC.

Apparatus for measurement of oxidation–reduction potential. H. EGGERS and H. MOHR (Biochem. Z., 1939, **302**, 211—219).—The small, all-

purpose apparatus, which is made almost entirely of glass, has the following advantages: high reliability, stability, parts interchangeable and easily accessible, easily cleaned, easily supplied with N_2 and H_2. N_2 from a cylinder is freed from O_2 with aq. $Na_2S_2O_4$ + NaOH with rosinduline GG as indicator.

W. McC.

Barometric correction nomograph for hydrogen electrode. G. F. KINNEY (Ind. Eng. Chem. [Anal.], 1939, **11**, 530).—A nomograph for evaluating the barometer correction, between pressures of 720 and 770 mm., to be applied to H electrode measurements has been constructed from Clark's data (" Determination of H Ions," 1928), and is reproduced.

L. S. T.

Improved agar bridge for p_H measurements. A. VAN KREVELD (Chem. Weekblad, 1939, **36**, 786—787).—The lower limbs of an H bridge are drawn out and bent upwards; the upper vertical limbs are fitted with taps connecting with small funnels. The horizontal tube carries a small funnel in the middle, is slightly bowed downwards, and is filled with solidified KCl–agar. The vertical limbs are filled with saturated KCl solution. After a measurement the bridge is " cleaned " by allowing a few drops of KCl solution to run out from the bottom of the vertical limbs. The bridge has no asymmetric potential. S. C.

Cathodic indicator, and its application to electrometry. A. A. KRIUKOV (J. Appl. Chem. Russ., 1939, **12**, 831—835).—Apparatus is described.

R. T.

Hollow cathode source for the Zeeman effect. R. A. FISHER and A. S. FRY (Physical Rev., 1939, [ii], **56**, 675—677).—A modification of the Schüler type of hollow-cathode discharge tube adapts it for use in magnetic fields. Details of the design and operating characteristics of the tube are discussed. N. M. B.

Exhaust valve for pneumatic cloud chambers. L. FUSSELL, jun. (Rev. Sci. Instr., 1939, **10**, 321—322).—The valve consists of an inverted metal cup resting on $\frac{1}{16}$-in. soft rubber and is operated in $\sim$0·003 sec. by a magnet constructed from the field coil of a dynamic loud-speaker. The design allows vac. tube control of forces up to 75 lb. and is suitable for operation by Geiger counter discharges.

D. F. R.

Cloud chamber control circuit. I. A. GETTING (Rev. Sci. Instr., 1939, **10**, 323—324; cf. preceding abstract).—The circuit operates on 110-v. d.c. mains and employs Ne-filled cold-cathode thyratrons to control the loud-speaker magnet expansion valve. The cycle of operation of the expansion valve may be easily adjusted and very accurately reproduced.

D. F. R.

Cloud chamber with electrical automatic control. F. BARENDREGT and G. J. SIZOO (Physica, 1939, **6**, 1077—1084). L. J. J.

Absolute measurement of electrical resistance. H. R. NETTLETON (Nature, 1939, **144**, 782—783).—Resistances of $\sim$1 ohm can be rapidly measured with an accuracy of a few parts in 10^5 by the method outlined.

L. S. T.

Radium exposure meter. L. F. CURTISS (J. Res. Nat. Bur. Stand., 1939, **23**, 479—484).—The modified form of Geiger–Müller counter described has a range of sensitivity suitable for indicating when the tolerance dosage of γ-ray exposure is exceeded. A meter indicates the actual exposure, whilst a light and buzzer are set in operation when the exposure exceeds the equiv. of 0·1 r. per day. The applications of the instrument, which is portable and operates from an a.c. supply, are discussed. J. W. S.

Improved method of making permanent electrets, and factors which affect their behaviour. W. M. GOOD and J. D. STRANATHAN (Physical Rev., 1939, [ii], **56**, 810—813).

N. M. B.

Cyclotron of the Biochemical Research Foundation. A. J. ALLEN, M. B. SAMPSON, and R. G. FRANKLIN (J. Franklin Inst., 1939, **228**, 543—561).—The construction and dimensions of a cyclotron which will deliver a current of 30 μa. of deuterons at 11 Me.v. on an external target are described. Ion sources using W ribbon filaments are employed.

A. J. M.

Perdue cyclotron. W. J. HENDERSON, L. D. P. KING, J. R. RISSER, H. J. YEARIAN, and J. D. HOWE (J. Franklin Inst., 1939, **228**, 563—579).—The construction and dimensions of a cyclotron, built mainly from standard materials, are described.

A. J. M.

Efficiency of Geiger–Müller counters. R. S. SHANKLAND and C. H. TINDAL (Phil. Mag., 1939, [vii], **28**, 562—570).—The counter efficiency η depends on the resistance and capacity of the coupling circuit and on the overvoltage and rate of counting. In the experiments described discharges are initiated by photons which eject an ionising particle into the active vol. of the counter. The vals. of η agree, for low rates of counting, with those found from cosmic ray studies. For precise intensity measurements accurate data for η for the counter must be known. The use of two or more counters to study coincidences will fail to record a considerable no. of these unless the counting rates are low.

T. H. G.

Modulation of Geiger counters. J. N. SHIVE (Physical Rev., 1939, [ii], **56**, 579—586).—An investigation of the behaviour of Geiger–Müller counters under low- and high-frequency modulation, obtained by the syperposition of an a.c. voltage wave on the d.c. counting threshold, is described. For frequencies up to $\sim$500 kc. such modulation could be successfully carried out. For some counters the breakdown process is ascribed to the liberation of electrons from the cathode by positive ion impact; for others the photoelectric liberation of electrons from the cathode is predominant. Counters showing evidence of both processes have been constructed. The theory of high-frequency modulation of counters is discussed.

N. M. B.

Point projector electron microscope. G. A. MORTON and E. G. RAMBERG (Physical Rev., 1939, [ii], **56**, 705).—Electron images of high magnification and resolution are obtained by use of the quasi-rectilinear propagation of the field emission from a minute cathode, in the form of an etched W or Mo point, close to the object, the arrangement being

essentially a transmission microscope. The magnification depends on the distance ratio cathode–viewing screen/cathode–object. The limit of resolution depends only on the distribution of initial velocities of the field electrons and on Fresnel diffraction by the object. Magnifications up to 3000 times of a 400-mesh electroplated Cu screen are illustrated.
N. M. B.

Portable apparatus for recording bursts of cosmic-ray ionisation. C. G. Montgomery and D. D. Montgomery (Rev. Sci. Instr., 1939, **10**, 350—352).—The change in potential of the collecting electrode in the ionisation chamber is amplified by a degenerative, directly-coupled valve amplifier. The output pulse is applied to a " magic eye " indicator which is used as a cathode-ray oscillograph and photographed on moving paper. Three 3-in. diameter ionisation chambers, with $\frac{1}{16}$-in. Fe walls, and filled with A or N_2 at 20 atm., are connected in parallel. The apparatus is sufficiently portable for use in mines.
D. F. R.

Determination of the size of crystallites from the broadening of electron diffraction interference rings. T. Schoon and R. Haul (Z. physikal. Chem., 1939, **B**, **44**, 109—126).—A method of determining the mean diameter (d = 10—70 A.) of solid particles from the width of their electron diffraction rings is described. The measurement is effected microphotometrically by comparison with a standard prep. for which there is no broadening due to particle size (Au leaf). The resolution of overlapping rings is described. The method gives d vals. in agreement with X-ray data, and is more accurate for very small d. The size of the γ-Fe_2O_3 particles produced by oxidation of $Fe(CO)_5$ vapour at various temp. is studied (cf. A., 1940, I, 13).
A. J. E. W.

Testing of chemical balances. A. Craig (Ind. Eng. Chem. [Anal.], 1939, **11**, 581—582).—Tests showing whether the knife-edges of a balance are in good condition are described. Methods for detecting beam length error, tilting of the knife-edges, and horizontal and vertical parallax are given. L. S. T.

Analytical and micro-balances. A. W. Ainsworth (Ind. Eng. Chem. [Anal.], 1939, **11**, 572—573).—Factors such as variations in the Al alloy used for the beams, strains due to mechanical working, the grinding of the agate knife edges and their attachment to the beam, which are of major importance in the construction of balances satisfying modern requirements of accuracy and sensitivity, are discussed. Stages in the production of the beam, and the testing of knife-edges, are illustrated.
L. S. T.

Laboratory apparatus, its evolution and development. W. B. Warren (Ind. Eng. Chem. [Anal.], 1939, **11**, 574—576).
L. S. T.

Laboratory production of liquid N_2O_4. I. E. Joschpa and O. P. Spiridonova (J. Appl. Chem. Russ., 1939, **12**, 951—952).—Apparatus for production of liquid N_2O_4 is described. The reactions involved are: $2NaNO_2 + 2HNO_3 \rightarrow 2NaNO_3 + H_2O + NO + NO_2$; $2NO + O_2 \rightarrow NO_2$.
R. T.

Modified method of using Poiseuille's apparatus. J. Bhimasenachar (Proc. Indian Acad. Sci., 1939, **10**, **A**, 141—144).—A modified apparatus which is particularly useful for measuring η of highly viscous liquids at different temp. is described. Data for η of glycerol at 2·8—75° are recorded.
W. R. A.

Mercury vapour detector. T. T. Woodson (Rev. Sci. Instr., 1939, **10**, 308—311).—A portable optical detector is described.
F. J. G.

Apparatus for the determination of the melting trajectory of small amounts of substance. W. M. Smit (Chem. Weekblad, 1939, **36**, 750—752).—200—300 mg. of substance are heated in a tube containing an Anschütz thermometer (50° divided into 0·1°) placed in an air space inside a massive Cu block, heated in such a way that the difference of temp. between the block and the thermometer surrounded by the substance is const. at ~3°. The melting substance is viewed through slits cut through the block at 120° to one another. The block temp. is measured by a thermometer placed in a hole filled with Hg. M.p. curves are reproducible to within 3% in the temp. range 0—300°.
S. C.

Continuous liquid extractor. F. Reuter (J. Proc. Austral. Chem. Inst., 1939, **6**, 384—386).—The apparatus is designed for use with solvents lighter than H_2O and with quantities of liquid from 25 to >500 c.c.
F. L. U.

Two constant-pressure devices. A. Clow and G. Shand (J. Sci. Instr., 1939, **16**, 354—355).—In the first the change in gas pressure operates a pressure regulator in which a column of Hg makes and breaks an electric current. The latter energises a solenoid, the Fe core of which is sealed into the moving part of an all-glass valve. When the pressure falls and the solenoid is energised the armature flies up and jerks open the valve to restore the predetermined pressure. The second device operates through the reduction of Hg pressure on a rubber diaphragm. This rises and admits air to the system through an aperture which it otherwise closes.
T. H. G.

Research in instrumentation. P. Sherrick and L. D. Wilson (Ind. Eng. Chem. [Anal.], 1939, **11**, 576—579).—Solenoid stirring and electrodes for this purpose are described. The high c.d. that can then be employed reduce markedly the deposition times required for the routine determination of metals in alloys. The application of polarographic methods to industrial analyses is discussed.
L. S. T.

Laboratory lifting device. G. Calingaert (Ind. Eng. Chem. [Anal.], 1939, **11**, 552).—An automatic jack mounted on a plate, and serving to raise and lower heating baths, and to control accurately the heat required in a fractional distillation, is described.
L. S. T.

Rapid operating device for Orsat apparatus. F. Cook (Ind. Eng. Chem. [Anal.], 1939, **11**, 551—552).—The device described permits a positive control by the presence of H_2O over the Hg in the levelling bulb. The continual raising and lowering of this bulb is eliminated. The time required for an analysis is reduced to one half by this device.
L. S. T.

Device for subliming iodine. J. Cornog and L. Olson (Ind. Eng. Chem. [Anal.], 1939, **11**, 551).—I

residues (~500 g.) obtained by wet methods are placed in a beaker next to another beaker containing P_2O_5 on a shelf on the floor of a desiccator, and the I is sublimed on to the sides and bottom of the desiccator by the heat from an electric bulb cemented into the lid. Other volatile substances easily decomp. at relatively low temp., *e.g.*, ICl, can be recovered by this method. L. S. T.

Modified Jones reductor. W. A. TAEBEL (Ind. Eng. Chem. [Anal.], 1939, **11**, 550).—Definite and const. rates of flow can be obtained by fitting the delivery tube of the reductor with capillary tubes of different-sized orifices. L. S. T.

Distillation capillary. A. O. GETTLER (Ind. Eng. Chem. [Anal.], 1939, **11**, 559).—The introduction of asbestos fibres during the construction of the capillaries described by Gettler and Fine (A., 1939, I, 582) prevents during use sudden ejection of the contents of the bulb into the stem of the capillary. L. S. T.

Reflux regulator and head for laboratory rectifying columns. F. D. ROSSINI and A. R. GLASGOW, jun. (J. Res. Nat. Bur. Stand., 1939, **23**, 509—514).—The top of the rectifying column is fitted with an unlubricated glass valve whereby the distillate can be returned over a drop counter to the rectifying column or over another drop counter to a receiver, thus permitting determination of the throughput and reflux ratio. Devices are also introduced to permit distillation to be carried out at various pressures. J. W. S.

Theory of the method of Clusius and Dickel for the separation of isotopes. L. WALDMANN (Z. Physik, 1939, **114**, 53—81; cf. A., 1939, I, 341).—An extension of the theory previously developed. A non-linear second-order partial differential equation accounts for the combined actions of convection, thermo-diffusion, and ordinary diffusion, and relates vertical particle transport with difference in concn. at opposite ends of the tube. Conditions for continuous operation of a separation tube are discussed. L. G. G.

Automatic Pirani vacuum gauge. E. J. SCOTT (Rev. Sci. Instr., 1939, **10**, 349—350).—The pressure is indicated on a galvanometer scale by placing the Pirani resistance in the grid circuit of a triode valve. D. F. R.

Volume-shape factor of particulate matter. Probable errors in the computation. J. M. DALLA VALLE and F. H. GOLDMAN (Ind. Eng. Chem. [Anal.], 1939, **11**, 545—546).—Evidence of the variation in shape factor for crushed quartz particles between the range of Bureau of Standards 10- and 40-mesh screens is presented. The best val. of this factor is that found from the average particle wts. of several aliquots of the aggregate, each including a large no. of particles. L. S. T.

Periodic action [of nitric acid on amalgamated lead]. E. E. WARK and I. W. WARK (Nature, 1939, **144**, 833).—A lecture demonstration. The Pb dissolves with the periodic liberation of N oxides. L. S. T.

Geochemistry.

Atmospheric ozone at Bombay. M. W. CHIPLONKAR (Proc. Indian Acad. Sci., 1939, **10**, **A**, 105—120).—The average [O_3] of the atm., measured daily from Oct., 1936, to Sept., 1938, with a Dobson spectrograph at the Colaba Observatory, Bombay, and its seasonal variation agree generally with that predicted by Dobson (A., 1931, 59). Unknown disturbing factors in the annual variation are indicated. The daily [O_3] is independent of the pressure at the ground level. W. R. A.

Decrease in the amount of iodine in the air over Central Europe, its cause, and its importance in relation to the iodine content of foodstuffs. H. CAUER (Angew. Chem., 1939, **52**, 625—628).—Analyses indicate that the I content of the atm. over Germany has decreased rapidly since 1923. Possible causes are discussed, including the diminution in the amount of I passing into the atm. during its extraction from seaweed in France and Scotland. The possible effects on the population of I deficiency in plant and meat foodstuffs, and means for overcoming these deficiencies, are also discussed. J. W. S.

Isotopic composition of rain water. R. V. TEISS (Compt. rend. Acad. Sci., U.R.S.S., 1939, **23**, 674—678).—Analyses of thunderstorm (I) and non-thunderstorm (II) rain indicate that ρ for (I) is $>$ average ρ (Moscow tap-H_2O) $>$ ρ for (II). W. R. A.

Corrosive effect of rain in the region of Vesuvius. O. BOTTINI (Annali Chim. Appl., 1939, **29**, 425—433).—The destructive effect on vegetation by rain in the region of the volcano is due to presence of free acid (mainly HCl); the p_H is sometimes as low as 2·78. Data for content of Cl′, SO_4'', SO_3'', NO_3', SiO_2, Ca, Mg, K, and Na are tabulated. F. O. H.

Molybdenum in mineral, mine, and surface waters. I. P. NOVOCHATSKI and S. K. KALININ (Compt. rend Acad. Sci. U.R.S.S., 1939, **24**, 278—279).—Mo is widespread in waters in Russia, the highest Mo content (0·06% of dried residue) being found in thermal springs connected with granites and diorites. Lower Mo content is found in waters connected with Cu or polymetallic deposits containing Mo. The low content of surface waters is attributed to adsorption of Mo by freshly pptd. Fe and Mn hydroxides. C. R. H.

Organic matter in water of certain seas. V. G. DATZKO (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 294—297).—The content of C and N in various Russian seas has been determined and calculations of the probable protein and carbohydrate content have been made. The Greenland, Black, and White Seas are similar to the Atlantic as regards org. content, whereas the Sea of Azov and Caspian Sea have a higher org. content approaching that of certain Danish lakes. C. R. H.

Geochemistry of the Saragota basin. Radioactivity of Saragota spring waters and rocks. O. Baudisch and A. K. Brewer (Amer. J. Sci., 1939, **237**, 811—817).—The radioactivity of these springs and deposits has been re-examined (A., 1914, ii, 609) by a method in which β-ray emission is measured by a special counter. The only radioactive elements detected were Ra and K. The KCl from Hathorn H_2O has approx. the same radioactivity as that of ordinary KCl. This may preclude the possibility that ^{40}K is formed continuously by processes associated with cosmic rays. The results for Ra confirm those obtained previously (*loc. cit.*), the spring waters containing slightly $> 10^{-10}$ g. of Ra per l. Time and the hydrostatic level of the waters have produced only minor changes in the radioactivity. L. S. T.

Measurement of p_H in the Atlantic and Pacific Oceans. J. Rouch (Compt. rend., 1939, **209**, 634—635).—Colorimetric p_H vals. (8·08—8·26) for surface sea-H_2O at different latitudes are given. The highest vals. were obtained near the Equator in the Pacific. A. J. E. W.

Hydrochemical characteristics of the waters of Neva Bay. I. V. Baranov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 592—595).—There is no vertical stratification of the principal hydrochemical elements in the waters of Neva Bay, but the Cl content varies between 3 and 3200 mg. per l. There is little total mineralisation and the p_H is not const. (6·9—9·2). CO_2, CO_3'', O_2, and p_H show circular horizontal distribution in summer and more pronounced vertical stratification than in winter. The waters are becoming more contaminated. F. J. L.

Hydrogeological survey of the valley of the river Viatka. S. G. Kashtanov (Utsch. Zap. Kazan State Univ., 1938, **98**; Geol., Nos. 11—12, 3—82).—A no. of analyses of river, ground, and underground waters is given, together with a hydrogeological survey of the district. S. I. T.

Relation between chlorinity and density of Caspian Sea-water. A. V. Trofimov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 929—932).—Formulæ are given for calculation of ρ for Caspian Sea-H_2O from the Cl content of samples. L. J. J.

Oxidising activity and p_H of brown sediments of the Barentz Sea. A. V. Trofimov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 925—928).—A thin layer of high acidity and oxidising activity has been detected by p_H and oxidation–reduction potential measurements at <15 cm. beneath the surface of mud on the bed of the Barentz Sea. This layer marks the boundary between oxidised upper and reduced lower layers. L. J. J.

Annual changes in the hydrochemical conditions in the Yashalta lakes. V. I. Nikolaev and B. I. Stepanov (Compt. rend Acad. Sci. U.R.S.S., 1939, **24**, 334—337).—Data are recorded for variation of temp., total salts, and metamorphisation coeff. ($MgSO_4 : MgCl_2$ ratio) during the course of a year. L. J. J.

Boron content of the salt deposits in the south basin of the Permian Sea and in the salt lakes of the Caspian Lowlands. I. N. Lepeschkov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 586—588).—A high B content (0·02% B_2O_3) has been found in the salt cores of various beds in the Aktyubinsky, Chkalovsky, Saratovsky, and Bashkir regions, in bore-hole waters in Bashkir (0·06% B_2O_3), and in brines from lakes of Western Kazakhstan. The salt lake brines were mineralised at the expense of the deep Permian salt deposits which are characterised by a high content of K, H_2SO_4, B, and Br. F. J. L.

Fundamental physico-chemical laws of development of salt lakes. I. Natural classification of salt lakes, based on the composition of their water. M. G. Valjaschko (J. Appl. Chem. Russ., 1939, **12**, 955—966)—The classification depends on the amount and nature of the solutes. R. T.

Age of the recent lacustrine period of the Caspian Sea and metamorphisation of salts of the river discharge in the sea. S. V. Bruevicz (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 695—698). W. R. A.

Minerals from deep sea cores and surface deposits of Bermudian calcareous sediments. J. A. Young, jun. (Amer. J. Sci., 1939, **237**, 798—810).—The lithological characteristics and mineralogy of deep sea sediments brought up by five cores taken from near Bermuda from depths ranging from 1320 to 3338 m. are discussed. The mineral content, insol. in HCl, of these sediments is compared with that of the eolianites and of modern beach and dune sands. The origin of the minerals found is discussed. L. S. T.

Radium content of an ocean-bottom core. C. S. Piggot and W. D. Urry (J. Washington Acad. Sci., 1939, **29**, 405—410; cf. A., 1933, 368).—A Ra analysis of a uniform core, consisting of ~50% $CaCO_3$ and 50% clay and silt, from a position east of Halifax, Nova Scotia, off the Newfoundland Banks, shows that the Ra content, which does not diminish with depth, is close to the Ra content, on an air-dried basis, of granites (~$1·6 \times 10^{-12}$ g. of Ra per g.). For the time represented, the presence or absence of U has no bearing on the Ra content. The Io is present probably in an amount corresponding approx. with radioactive equilibrium with the Ra. Chemical deposition plays no rôle in the radioactivity of this core. L. S. T.

Helt Township (Indiana) meteorite. S. H. Perry (Smithsonian Miscell. Coll., 1939, **98**, No. 20, 1—7).—The meteorite (~230 g.) consists mainly of kamacite with some plessite fields, a sparing development of taenite, and numerous schreibersite inclusions. Photomicrographs are reproduced. L. S. T.

X-Ray study of some meteoric irons. E. A. Owen and B. D. Burns (Phil. Mag., 1939, [vii], **28**, 497—519).—24 meteorites have been examined following heat-treatment in various ways. After long annealing at 350° and cooling rapidly it was found that the spectral lines were well defined, the α-lines being better than the γ. Meteorites with <6·2% Ni yield only the α-phase whilst those with >6·2% contain both the α- and γ-phases. The α-spacing increases with the Ni content up to 6·2% Ni, remaining ≃ const. for this and higher % at 2·8628 A.

to within 1 part in 30,000. It is concluded that the compositions of the kamacite in the octahedrites and of the kamacitic component of plessite are the same. The γ-spacing varies very considerably from one meteorite to another and a possible explanation of this is offered. The octahedrites display remarkably const. α-spacings after heat-treatment at 350°, 400°, and 500° but with the Ni-rich ataxites considerable variations are observed analogous to those found with similar artificial alloys. Unannealed specimens give results similar to the above but the lines are badly defined. T. H. G.

Viscosity of meteorites. M. P. Volarovitsch and A. A. Leonteeva (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 589—591).—The softening point of indochinite is 1070° and of moldavite 1100°. Tectites when kept at 1400° cake into a homogeneous mass and then sinter into a glass. The η of tectites (I) from Indo-China, moldavites (II), and a stony meteorite from Saratov (III) have been measured in their softening range by the rate of extension of a prism $3{\cdot}0 \times 0{\cdot}6 \times 0{\cdot}6$ cm. at const. temp., and in the molten state by Stokes' method. The η of (I) is $1{\cdot}06 \times 10^9$ at 950°, $1{\cdot}22 \times 10^5$ at 1400°, (II) $1{\cdot}70 \times 10^9$ at 980°, $2{\cdot}30 \times 10^5$ at 1410°, (III) $1{\cdot}48 \times 10^4$ at 1390°, $1{\cdot}15 \times 10^4$ at 1410°. These vals. lie between those of quartz and ordinary glass and indicate that the meteorites are of cosmic origin. F. J. L.

Kinematical relativity and the geological time-scale. G. J. Whitrow (Nature, 1939, **144**, 706).—The uniform time of radioactive decay is identified with the t-time of kinematical relativity, according to which the "age of the universe" is $\sim 2 \times 10^9$ years. A comparison of the dates assigned to various geological epochs by radioactive methods and the corresponding dates in dynamical time shows that the two measures of the whole fossil period differ by an amount $\not>$ the probable error in estimating it. L. S. T.

Absolute value of the principal piezoelectric modulus of quartz. A. Langevin (Compt. rend., 1939, **209**, 627—630).—The abs. val. of the modulus is slightly $>7 \times 10^{-8}$ c.g.s. unit; the divergence of previous vals. is due to the undetected occurrence of twins with a common optic axis. A. J. E. W.

Structure of natural wollastonite. M. A. W. Barnick (Mitt. Kaiser-Wilh. Inst. Silikat-Forsch., No. 172, 36 pp.; Chem. Zentr., 1937, i, 3295).—Wollastonite, CaO,SiO_2, has a 15·33, b 7·28, c 7·07 A., β 95° 24·5′; 12 mols. in unit cell; space-group C_{2h}^5—$P2_1/a$. At. parameters are given. Each Si atom is surrounded by 4 O in a distorted tetrahedron, three such units forming a ring (Si_3O_9) which lies in the (010) plane. The Ca are of three types, associated with 6 or 5 adjacent O, with 4 and 4 or 3 other O, respectively. A. J. E. W.

Selenium in Canada. H. G. Byers and H. W. Lakin (Canad. J. Res., 1939, **17**, **B**, 364—369).—Examination of portions of Alberta, Saskatchewan, and Manitoba indicates a very large area of seleniferous soil. Shales contain 0·3—3·0 p.p.m. of Se, and the soils from 0·1 to 6 p.p.m., whilst the vegetation contains 3 to 4190 p.p.m. T. H. G.

Hibschite in Georgia. D. S. Beljankin and V. P. Petrov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 349—352).—A new bed of hibschite, associated with contact between chalk marls and teschenites, is described. Optical consts. are recorded for hibschite and associated wollastonite, xonotlite, thomsonite, pyroxene, and garnet. L. J. J.

Conversion of astrakhanite. I. G. Drushinin (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 921—924).—Heating curves for natural and synthetic astrakhanite $(Na_2SO_4,MgSO_4,4H_2O)$ show four endothermal effects between 25° and 700°. The transition astrakhanite–löweite with loss of $2H_2O$ occurs at 105—110°. The remaining H_2O is lost at 215°. The transition points at 240° and 575—580° characteristic of Na_2SO_4 and $MgSO_4$ are absent. $Na_2SO_4,MgSO_4$ has a transition point at 625° and melts at 670°. L. J. J.

Pewabic mine [Hanover, New Mexico]. H. Schmitt (Bull. Geol. Soc. Amer., 1939, **50**, 777—818).—The sedimentary and igneous rocks, geologic structure, and contact pyrometasomatism of this area are described. The mine exploits a deposit of sphalerite associated with pyrometasomatic silicates. The ore is essentially Pb-free, and is low in Cu and other metals. A table of gains and losses of oxides in the metamorphic zone shows that the chief gains were in Fe oxides, SiO_2, Zn, Mn oxides, S, and Al_2O_3; the losses were in CO_2 and CaO. The vol. during replacement remained practically const. Paragenesis and the origin of mineralisation are discussed. Chemical analyses of the igneous rocks, the hypogenic and pyrogenic minerals, the dolomites and limestones, and analyses showing progressive metamorphism of certain rocks of the area, are recorded. Spectrographic analyses of certain minerals are tabulated, and individual minerals, with their optical consts., are described. L. S. T.

Structural petrology of the Val Verde tonalite, S. California. E. F. Osborn (Bull. Geol. Soc. Amer., 1939, **50**, 921—950).—The results of micrometric analyses are described. Radioactivity measurements on numerous samples of the tonalite and of granodiorite, granite, schist, gabbro, etc. are recorded. They show no definite correlation, as yet, between mineralogic data and radioactivity. L. S. T.

Igneous rocks of the Highwood Mountains, Montana. I. Laccoliths. C. S. Hurlbut, jun. [with D. T. Griggs] (Bull. Geol. Soc. Amer., 1939, **50**, 1043—1112).—The structure, petrography, and petrogenesis of nine laccoliths, eight of which have been intruded into upper Cretaceous Eagle sandstone, are described. Rock ρ and heavy mineral % in the Shonkin Sag laccolith, and chemical analyses of this and the Square Butte laccolith, are recorded. L. S. T.

Mineralogy of the Ilmen Mountains. A. F. Sosedko (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 596—598).—New nephelite pegmatites are reported at Mt. Kossaya. The ilmenites from Mt. Lokhmataya are heterogeneous and separable magnetically into two minerals. One is true ilmenite, whilst the other closely resembles ilmenorutile. F. J. L.

Deposits of oxidised nickel minerals in the Urals. B. BOGITCH (Compt. rend., 1939, **209**, 652—653).—The Orsk region yields Ni silicate minerals (chiefly garnierite, <2% Ni) of similar origin to those of New Caledonia. Other regions contain Ni minerals closely associated with marble deposits, resulting from decomp. of serpentines; the Ni content varies from 1—1·5 to 10—15% immediately adjacent to marble (mean 2—3%). The total Ni available is ~400,000 metric tons. A. J. E. W.

New type of metamorphic rocks (sakenites) forming part of the crystalline schists of Southern Madagascar. A. LACROIX (Compt. rend., 1939, **209**, 609—612).—The sakenites consist of anorthite or a closely related plagioclase, associated with spinel, sapphirine, corundum, or leuco-augite. The types are described. A. J. E. W.

Green zircon. J. BOLMAN (Chem. Weekblad., 1939, **36**, 752—753).—A yellow-green zircon from Ceylon had d 4·132, double refraction 0·050, n_D= 1·8472—1·8522, 1·8397, 1·8405—1·8440 (ω–ε) at right angles, along, and at 45° to the optical axis, respectively. S. C.

Alteration of allanite. S. HATA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 301—311).—Analytical data are recorded for fresh and weathered allanite from the Abukama granite region. The products of weathering are mainly hydrous Fe_2O_3 and Al_2O_3 containing SiO_2 and CO_2. Weathering increases the ThO_2 and decreases the CaO and rare earth contents. Leaching with K_2CO_3 solution gives a product similar to weathered material. Resistance to weathering is found when the $Fe_2O_3 : Al_2O_3$ ratio is >1·3 and the ThO_2 content <1·5%. L. J. J.

Demantoid from the ultra-basic rocks of Azerbaidjan. M. A. KASCHKAI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 507—509).—The occurrence of the mineral is described. F. J. G.

Oxidation–reduction potentials as applied to the study of the paragenesis of minerals. V. V. SCHTSCHERBINA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 503—506).—The occurrence of certain combinations of minerals and the non-occurrence of others can be accounted for in terms of oxidation–reduction potentials. F. J. G.

Action of water on natural (Inder) borates at various temperatures. N. M. SELIVANOVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 499—502).—On prolonged treatment with H_2O at 20°, 50°, or 100°, inyoite, $Ca_2B_6O_{11},13H_2O$ (I), is transformed into colemanite, $Ca_2B_6O_{11},5H_2O$, and this into pandermite, $Ca_8B_{20}O_{38},15H_2O$. Hydroboracite, $CaMgB_6O_{11}6H_2O$ (II), very slowly affords asharite. Prolonged treatment of kaliborite, $KMg_2B_{11}O_{19},9H_2O$, with gypsum and H_2O at 20° affords (I) and (II). F. J. G.

Pseudomorphs after leucite in the "mica trap" of the Jharia coalfield. N. L. SHARMA (Current Sci., 1939, **8**, 421).—Patches of isotropic or weakly birefringent material have been found forming equidimensional grains with which cryptocryst. quartz, calcite, or limonite sometimes occurs. The grains have n < Canada balsam < apatite which is also present. It is concluded that they are of an isometric mineral, probably leucite, which has been replaced or altered by felspathic material during the late magmatic changes undergone by the rock. T. H. G.

Dolomitisation of calcareous sediments. A. RIVIÈRE (Compt. rend., 1939, **209**, 597—599).—Experiments are described which show that the fall of p_H and reserve alkalinity in sea-H_2O in contact with $CaCO_3$ is due to pptn. of $MgCO_3$, and not to supersaturation of the H_2O with $CaCO_3$. The p_H fall is due to liberation of CO_2. A. J. E. W.

Rocks from Persia [Iran]. A. M. SEDLACEK (Min. Petr. Mitt., 1939, **51**, 261—293).—Descriptions are given of the microscopical characters of minerals in various plutonic and metamorphic rocks collected in the desert region of eastern Iran. L. J. S.

Hydrothermal alteration of igneous rocks. G. M. SCHWARTZ (Bull. Geol. Soc. Amer., 1939, **50**, 181—237).—The hydrothermal alteration of igneous rocks is limited here to the changes which a rock undergoes, after consolidation, through the agency of hot solutions and subordinate gases. Primary texture is destroyed approx. $\propto$ the intensity of alteration, but only in extreme examples is it entirely removed. Softening and bleaching of the rocks are common effects, but processes such as silicification and albitisation may result in a freshened appearance. Red and brown colours are commonly developed by oxidation of pyrite or other minerals when the rocks are exposed at the surface. Vol. changes are usually not extensive, but some porosity generally results. The most important minerals developed in igneous rocks during hydrothermal alteration are quartz, sericite (I), chlorite (II), epidote (III), carbonates, and pyrite. Less common but locally important are alunite (IV), kaolinite, adularia (V), biotite, serpentine, albite, tourmaline, fluorite (VI), and many sulphides. Minerals characteristic of this alteration are (I), (IV), (V), (VI), (II), and (III). Numerous examples of these mineralisations are described. Chemical changes are discussed on the basis of numerous analyses of fresh rocks and their hydrothermally-altered rock equivs. Relative gains and losses of the most important oxides are shown diagrammatically for the processes of silicification, albitisation, sericitisation, carbonation, and hydrothermal alteration. The average of the analyses shows a small net loss in SiO_2 and Al_2O_3, a greater loss of Fe^{III} and Fe^{II}, and a relatively large loss of MgO, CaO, and Na_2O. K_2O and H_2O show a net gain. Consideration of the average or net results alone may be misleading, as good examples of hydrothermal alteration of igneous rocks which show relative gains or losses for each important oxide are available. The need for more analyses of hydrothermally-altered basic rocks is pointed out. L. S. T.

Igneous rocks from Iran. E. CHRISTA (Min. Petr. Mitt., 1939, **51**, 172—260).—Detailed descriptions are given of the microscopical characters of minerals, particularly the alkali-felspars, from the volcanic rocks of Mt. Damavand in northern Iran, together with some remarks on the plutonic rocks of

the Elbruz range. A partial chemical analysis of a glassy trachyte is given. L. J. S.

Mineralogy and genesis of Mesozoic bauxites of the eastern slope of Ural Mountains. V. A. POLJANIN (Utsch. Zap. Kazan State Univ., 1938, **98**; Geol., Nos. 11—12, 153—210).—A no. of minerals from bauxites are described. They include alumogel, gibbsite, quartz, opal, chalcedony, halloysite, kaolinite, harmotome (analysed), heulandite, magnetite, hæmatite, goethite, lepidocrocite, siderite, chlorite, pyrite, gypsum, barite, and vivianite. It is suggested that bauxites were deposited from colloidal solutions together with a certain amount of detrital material. S. I. T.

Pieds des Monts uraninite. O. B. MUENCH (J. Amer. Chem. Soc., 1939, **61**, 2742—2744).—Analysis of a uraninite from Lac Pied des Monts, Quebec, gives Pb 6·67%, U 49·25% (Pb/U = 0·135), and a trace of Th. Correction for common Pb changes the ratio to 0·130, and the age of the mineral, calc. from this val., is 920×10^6 years. W. R. A.

Action of alkali sulphide solutions on minerals at elevated temperatures. J. L. LINDNER and J. W. GRUNER (Econ. Geol., 1939, **34**, 537—560).—The action of aq. solutions of H_2S, NaHS, and Na_2S on thin sections of common Fe-bearing minerals has been investigated in Au-lined bombs at $300° \pm 3°$. With H_2S and NaHS, pyrite is formed when Fe is removed from the original mineral, but with Na_2S, Fe oxides and FeS are produced. Hæmatite (I) is formed in many cases on Fe minerals in NaHS and Na_2S solutions, magnetite (II) by H_2S and Na_2S, and analcite by NaHS and Na_2S. Marcasite is formed on (I) in H_2S solution, chrysotile is formed from certain high Mg silicates in Na_2S solution, acmite is formed by Na_2S acting on fayalite (III), and chlorite (IV) from many minerals in presence of Na_2S. Cryst. S is pptd. on orthoclase (V) from Na_2S. SiO_2 is dissolved by all three solutions, and when pptd. it is generally in the form of opal. Au is readily sol. in aq. NaHS, but not in aq. Na_2S or H_2S. Kaolin minerals and nontronite are probably among the alteration products. Details of the action of these three solutions on augite, hornblende, olivine, (III), serpentine, antigorite, garnet, biotite, (IV), chloritoid, siderite, (II), (I), and (V) are recorded. L. S. T.

Colour of celestine. J. N. FRIEND and J. P. ALLCHIN (Nature, 1939, **144**, 633).—The blue and red colours of certain specimens of celestine (I) from Yate, Gloucestershire, are attributed to colloidal Au. Spectrograms showed well-defined lines of Au in red and blue (I), and very faint lines in white (I). Chemical analyses gave for colourless, pale blue, and deep red crystals, Au 0, 49, 85 and Fe 19, 4, and 4 p.p.m., respectively. L. S. T

Physical properties of the mineralogical constituents of vredenburgite from India. S. DEB (Compt. rend., 1939, **209**, 518—520).—Microscopic, *X*-ray, and magnetic data for vredenburgites and typical specimens of the constituent minerals (hausmannite and jacobsite) are compared. The constituents have separated from a homogeneous medium on reduction of temp. or pressure. A. J. E. W.

Mineral composition of the Mount Lyell copper ores, Tasmania, and their modes of occurrence. A. B. EDWARDS (Proc. Austral. Inst. Min. Met., 1939, No. 114, 67—109).—The general geology of the Mount Lyell Field, the mineralised zones and occurrence of the ore-bodies, and the origin of the schists are described. The mineralisation has been mainly pyritic, but local concns. of Cu minerals constitute ore bodies of three types, viz., disseminated chalcopyrite (I) ores with 1·5—2·5% Cu; bornite–(I) ores, in part massive, with 3—25% Cu; and massiv epyritic ore bodies with 1·5—2·5% Cu. Chemical analyses of these ores are recorded. The bornite–(I) ore shows a marked concn. of Zn, Pb, and Ni, and, to a smaller extent, Ag and Au. Traces of Co, Mo, As, Sb, Se, and Te occur in the ores. Minerals described include magnetite, hæmatite, pyrite, enargite, sphalerite, (I), bornite, berzelianite (?), cubanite, tennantite, tetrahedrite, linnaeite, pentlandite, molybdenite, galena, Au, electrum, Cu, melaconite, covellite, and chalcocite. L. S. T.

Significance of the iron oxide outcrop at Mount Oxide, Queensland. R. BLANCHARD (Proc. Austral. Inst. Min. Met., 1939, No. 114, 21—50).—The general geology and the geology and occurrence of the chalcocite (I) ore deposit of Mount Oxide are described. The accepted view, that the haematite-specularite mass associated with the (I) represents the residuum of an original medium to low-grade primary pyrite–Cu sulphide mass from which the (I) ore-shoot has been derived by leaching, is discussed critically. The mass exhibits none of the essential characteristics of a sulphide derivative, and it is regarded as a body of primary Fe ore. An explanation of its proximity to the (I) is advanced. L. S. T.

Origin of the "Jasper Bars" of Western Australia. H. E. MCKINSTRY (Proc. Austral. Inst. Min. Met., 1939, No. 114, 51—64).—" Jasper Bars," which are typified by striped rock consisting of alternate layers of white or pinkish SiO_2 with red to brown bands of Fe-bearing SiO_2, resemble in appearance and composition banded Fe formations in many other parts of the world, and, like them, are of sedimentary origin. L. S. T.

Lollingite, and the occurrence of cobalt and nickel in the Broken Hill lode. F. L. STILLWELL and A. B. EDWARDS (Proc. Austral. Inst. Min. Met., 1939, No. 114, 111—124).—The results of a microscopical examination of lollingite (I) from Broken Hill are described and illustrated by photomicrographs. The replacement of (I) by arsenopyrite (II) is illustrated by means of chemical analyses of (I) from North Broken Hill mine, and of (I) and (II) from Zinc Corporation mine, Broken Hill. Ore solutions containing As appear to have been replaced by sulphide ore solutions in the course of development of the lodes. The % of Co and Ni in (I) are variable, but the ratio Co : Ni is $\sim$3 : 2. (I), but not (II), is etched by 20% $FeCl_3$. The formula of (I) should be written $(FeCoNi)As_2$. L. S. T.

Geology and mineralisation of the north-eastern Humboldt Range, Nevada. E. N. CAMERON (Bull. Geol. Soc. Amer., 1939, **50**, 563—634; cf.

A., 1939, I, 344).—The general geology of the area, the deposits of Au, Ag, and Sb, found in fissure veins, bed veins, in rhyolite and granite porphyry, etc., and the development of the ores are described. Mineralisation appears to have been effected by solutions genetically related to the granitic magmas. In most of the deposits the development of commercial Ag ores is due to enrichment of lean sulphide ores by supergene argentite, native Ag, and, possibly, cerargyrite. L. S. T.

New deposits of volkonskoite in Udmurtia. N. P. KULTISCHEV (Utsch. Zap. Kazan State Univ., 1938, **98**; Coll. of Students' Work, No. 1, 89—104).—New deposits of volkonskoite found in Sharkan and other localities are described and seven analyses are given. S. I. T.

Classification of some magnesial silicates and their alumo-analogues. N. E. EFREMOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 287—289).—Comparison between magnesial hydrosilicates and their alumo-analogues is suggested in order to clarify the classification of the argillaceous hydrosilicates. An indication of the initial mols. and of the Al_2O_3/SiO_2 or $3MgO/SiO_2$ ratios is considered sufficient for classification purposes. The discovery in the North Caucasus of a sepiolite corresponding with $3MgO,3·66SiO_2,5·5H_2O$ and analogous to a montmorillonite, $Al_2O_3,3·66SiO_2,5·5H_2O$, is announced. C. R. H.

Contact metamorphism of phosphorites. P. L. BEZRUKOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 282—284).—The discovery in the Teshiktass anticline of the Kara-Tan range (South Kazakhstan) of a notable example of contact metamorphism of phosphorites into apatite is described. The apatite has an average P_2O_5 content of 21·3%, certain samples containing 32% of P_2O_5. C. R. H.

Part taken by close packing of crystals in the diffusion of helium. E. K. GERLING (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 274—277).—The influence of the crystal packing of minerals on the rate of loss of He is discussed. Since loose cryst. structures lose He easily, they are ill suited to the determination of geological age from the He content. C. R. H.

Crystallography of aramayoite. H. BERMAN and C. W. WOLFE (Min. Mag., 1939, **25**, 466—473).—Crystals of aramayoite (A., 1927, 225) with developed crystal-faces have now been found in Bolivia. Goniometric measurements give the axial ratios $a : b : c = 0·8753 : 1 : 0·9406$, α 100° 22′, β 90° 0′, γ 103° 54′, and X-ray measurements give a unit cell, a 7·76, b 8·79, c 8·34 A., containing $6Ag(Sb,Bi)S_2$. This lattice and orientation differs from that previously adopted (*ibid.*, 190). L. J. S.

Relation of chamosite and daphnite to the chlorite group. A. F. HALLIMOND [with C. O. HARVEY and F. A. BANNISTER] (Min. Mag., 1939, **25**, 441—465).—Detailed chemical analyses are given of daphnite from Tolgus mine, Cornwall, and of chamosite from the ironstones of Frodingham, Lincolnshire. These are compared and plotted with numerous published analyses of various chlorite minerals, and their composition is discussed. The X-ray data given by powder photographs of various chlorite minerals are discussed. Daphnite has a normal chlorite structure, like that of clinochlore, but chamosite has a special structure of the chlorite type. Under incipient metamorphism chamosite alters to bavalite, which has normal chlorite structure. L. S. J.

Genesis of the Novo-Troitzky iron ore deposit of the Khalilov type. G. I. TEODOROVITSCH (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 270—273).—The results of an investigation of the region are summarised and a rough scheme underlying the processes of formation and secondary changes is outlined. The Fe ores are normal aq. sediments mainly of chemical origin, *e.g.*, ferruginous chlorites, hydroxides, and hydrargillites, the peculiarity of their mineralogical composition and texture being ascribed to internal regroupings inside the sedimental mass. C. R. H.

Genesis of montmorillonite and kaolinite and conditions of their joint occurrence in the colloids of soils and clays. I. D. SEDLETZKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 510—514).—Evidence that montmorillonite (I) is formed under alkaline and kaolinite (II) under acid conditions is discussed. A prolonged period of prevailing alkaline or acid conditions leads to the formation of (I) or (II) clays, respectively. L. S. T.

Cost of soil in rock and time. W. H. TWENHOFEL (Amer. J. Sci., 1939, **237**, 771—780).—The time involved in the formation of an average thickness of soil, and the amount of rock destroyed in producing this thickness, are discussed. The vulnerability of different kinds of rock to attack, and the amount of soil resulting from the destruction of each variety, are considered. Chemical analyses of granite, diabase, argillite, and limestone, and the corresponding residual products are recorded. L. S. T.

Nature of laterisation.—See B., 1939, 1271.

Occurrence of wax-like substances in peaty fireclay. V. L. BOSAZZA (Nature, 1939, **144**, 835—836).—EtOH, $COMe_2$, or C_5H_5N extracts wax-like material from the chocolate-coloured fireclays of the Ecca Series of the Karroo System in the Witwatersrand area. The extracted substances oxidise when heated at 110° to a dark brown translucent material. The colour of the fireclay is unchanged by the extractions. L. S. T.

Wisconsin Silurian bioherms (organic reefs). R. R. SHROCK (Bull. Geol. Soc. Amer., 1939, **50**, 529—562).—The bioherms grew from calcareous matter produced by the inhabiting organisms, algæ, corals, brachiopods, molluscs, etc., and from salts pptd. directly from sea-H_2O. From low mounds they have increased in size until they appear now as irregular bodies of porous, massive, and structureless dolomite interrupting the uniform bedding of the regional stratigraphic sequence. L. S. T.

Problem of petroleum. F. G. CLAPP (Bull. Geol. Soc. Amer., 1939, **50**, 361—374).—The development of petroleum geology, technical progress, the rôle of geophysics, etc. are reviewed. L. S. T.

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BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

FEBRUARY, 1940.

Hyperfine structure and Zeeman effect of the resonance lines of lithium. D. A. JACKSON and H. KUHN (Proc. Roy. Soc., 1939, **A**, **173**, 278—285).—The hyperfine structure of the line λ 6708 A. has been observed by absorption in at. beams. The π components of the Zeeman effect of the line $2S_{\frac{1}{2}}—2^2P_{3/2}$ of ^{7}Li were resolved, four lines being observed in each component. The nuclear spin and magnetic moments of all the alkali metals are tabulated. G. D. P.

Stark effect of C I. Y. ISHIDA, T. TAMURA, and M. FUKUSHIMA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 417—418).—Measurements have been made over the range λλ 4000 to 5400 A. on 12 lines, including two new ones at λ 4371·8 and 4110·0 A. Field strengths up to 421 kv. per cm. were employed. D. F. R.

Conditions for excitation of the nitrogen spectrum at high altitudes. J. CABANNES and R. AYNARD (J. Phys. Radium, 1939, [vii], **10**, 455—458).—An attempt has been made to specify the conditions for the excitation of the mol. spectrum of N_2 in the night sky light, by explaining why the higher level of the Vegard–Kaplan bands has a vibration quantum of $v = 2$ or 3. The energy available in the night sky is the energy of recombination of O atoms which have been dissociated during the day by solar ultra-violet light. Assuming that recombination results from a triple collision with a N_2 mol., and that the O_2 and N_2 mols. share the available energy, various inferences have been made which have been tested by experiment. The notable exaltation of the band 6500—6550 A. of the first positive system of N_2 has been explained. W. R. A.

Arc spectrum of nitrogen (N I). II. A. Extreme ultra-violet region. M. KAMIYAMA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 375—384).—Using a 1-m. Siegbahn vac. spectrograph, 237 lines (120 new) were observed between λ 1850 and 850 A. A complete list of λλ and classifications is given. D. F. R.

Excitation of the green auroral line of oxygen. K. G. EMELEUS, R. H. SLOANE, and (MISS) E. B. CATHCART (Proc. Physical Soc., 1939, **51**, 978—988).—A study of the excitation in discharge tubes containing mixtures of A and O_2 confirms the early results of McLennan for the optimum conditions for obtaining the lines. With discharge tubes passing heavy currents, the line is emitted mainly from an aureole surrounding the central heavily ionised part of the gas, and the bearing of this on the production of other forbidden lines is pointed out. The collision processes involved in the production of metastable O atoms and in the quenching of the auroral line by impurities are considered, and the probable importance of resonant collisions with metastable A atoms is established. N. M. B.

Spectrum of Ne V. F. W. PAUL (Physical Rev., 1939, [ii], **56**, 1067).—Data for λλ and assignments of 7 lines in the range 572—480 A. are tabulated. N. M. B.

Resonance radiation of sodium. R. W. WOOD (Physical Rev., 1939, [ii], **56**, 1172—1173).—A lecture demonstration. N. M. B.

Intercomparison of doublet ratio and line intensity for interstellar sodium and calcium. O. C. WILSON (Astrophys. J., 1939, **90**, 244—248).—The mean small-scale velocity of the Ca ions is probably ~3 times that of the Na atoms. The relative nos. of Na atoms and Ca ions in space are discussed. L. S. T.

Atmospheric sodium. S. CHAPMAN (Astrophys. J., 1939, **90**, 309—316; cf. A., 1939, I, 439).—Na atoms in the high atm. may have a long, although intermittent, free life owing to the reaction $NaO + O = Na + O_2$. The source of energy of the light emitted by Na at night is ascribed to the dissociation energy of O_2. The level of emission of this light is discussed. L. S. T.

Isotope shift in magnesium. J. P. VINTI (Physical Rev., 1939, [ii], **56**, 1120—1132).—Mathematical. From an investigation as to whether nuclear motion alone can account for observed fine structure in Mg it is concluded that the quantum theory of nuclear motion, without the assumption of non-Coulomb nuclear fields or of nuclear spins, gives a good qual. explanation of the fine structure. N. M. B.

Absorption spectrum of bromine vapour in the region 3400 to 2200 A. R. G. AICKIN and N. S. BAYLISS (Trans. Faraday Soc., 1938, **34**, 1371—1374; cf. A., 1936, 1167).—The absorption coeff. of Br vapour passes through a min. at 3000 A. and increases to a max. at 2250 A. The intensity of absorption at the max. is $\ll$ in liquid or dissolved Br and is very susceptible to perturbing influences. A very weak band system appears to overlap the continuum. F. L. U.

Continuous absorption spectrum of bromine in solution. C. L. CHILD and O. J. WALKER (Trans. Faraday Soc., 1938, **34**, 1506—1515).—Extinction coeff. curves have been obtained for solutions of Br in CCl_4, $CHCl_3$, CS_2, C_6H_6, $PhNO_2$, H_2O, AcOH, and EtOH. The main effect of chemically inert solvents on the λ of max. absorption at 4150 A. is to increase the amount of absorption as compared with that of

Br vapour. In polar solvents $\lambda_{max.}$ is displaced towards the ultra-violet, EtOH causing the largest effect. No change of colour, as with I, is associated with solvation. The influence of the solvent in increasing absorption is discussed. F. L. U.

Absorption of light by crystals of bromine and other halogens at 20·4° K. A. NIKITINA and A. PRICHOTKO (Acta Physicochim. U.R.S.S., 1939, **11**, 633—646).—Absorption spectra in the region 7000—2100 A. are recorded for cryst. Cl_2 and I at liquid H_2 temp., and for cryst. Br at liquid N_2 and liquid H_2 temp. Cl_2 exhibits a band at ~5000 A., Br three, at ~4900, ~4200, and ~3650 A., and I two, at ~5500 and ~4750 A. F. J. G.

Effect of density on the displacement of high series lines of the alkali metals by foreign gases. C. FÜCHTBAUER and G. HÄUSLER (Naturwiss., 1939, **27**, 658—659).—The displacement of the Rb lines $1s$—$14p$ and $1s$—$20p$ towards the violet when Ne is added at temp. up to 600° K. is ∝ the relative d of the added gas. This agrees with earlier work on the displacement of high series lines of Na and K by the addition of inert gases. Contrary to Fermi's theory there was no indication of a transition of the displacement through zero to the red. A. J. M.

Hyperfine structure in the spark spectrum of iodine. S. TOLANSKY (Nature, 1939, **144**, 754—755).—A reply to Schmidt (A., 1939, I, 543). Confirmation of the author's data is afforded by Murakawa's results (A., 1939, I, 290). Nuclear electrical quadrupole moments calc. from hyperfine structure may all be in error, owing to configurational interaction. L. S. T.

Spectra of Y V and Zr VI. F. W. PAUL and W. A. RENSE (Physical Rev., 1939, [ii], **56**, 1110—1113; cf. Tomboulian, A., 1938, I, 544).—The Br I isoelectronic sequence is extended. Spectrograms for 150—1000 A. were obtained. The estimated abs. term vals. of the $^2P^0_{3/2}$ ground levels are 620,000 and 798,000 cm.$^{-1}$, respectively. N. M. B.

Stark effect of Hg I. Y. ISHIDA and S. HIYAMA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 390—416).—The Stark effect of Hg lines due to singlet and triplet terms has been measured, using field strengths up to 560 kv. per cm. It is shown that with high field strengths the effect of the end terms cannot be neglected for the lower principal quantum nos. D. F. R.

Intensity and cross-sectional distribution of the long-wave infra-red radiation (300 μ.) from the high-pressure mercury arc. W. DAHLKE (Z. Physik, 1939, **114**, 205—214).—The intensity of infra-red radiation, total, and restricted to ~300 μ., is determined as a function of Hg v.p., lamp load (w. per cm.), and lamp diameter, and its distribution across the total diameter of the radiation source is also examined. Conditions are outlined for max. production of long-wave radiation. L. G. G.

Element 87 (Ml). H. HULUBEI (Compt. rend., 1939, **209**, 675—678; cf. A., 1938, I, 5).—The X-ray spectroscopic detection of Ml in the heavy alkali-metal extracts of pollucite, pitchblende, soddite, and autunite-colombite, with the precautions used to obtain well-resolved spectrograms, are described. The difference of solubility of the alkali chlorides in EtOH is used to enrich the Ml preps. A. J. E. W.

Table of fundamental [spectrum] lines. A. T. WILLIAMS (Anal. Asoc. Quím. Argentina, 1939, **27**, 178—219).—The lines are tabulated in numerical order together with their intensities. F. R. G.

Spectrum of the torch discharge. Y. ASAMI and T. HORI (Nature, 1939, **144**, 981—982).—The torch discharge spectrum is essentially the same as that of the high-tension d.c. arc. In the flame part of the discharge, the spectrum consists chiefly of the O_2 (Runge), NO (γ), and OH bands, whilst near the electrode N_2 and N_2^+ bands, and easily-excitable lines of the electrode material, are intense. A continuous band, of unknown origin and extending from ~6000 A. to the red end, is emitted from all portions of the flame. L. S. T.

Atmospheric [light] absorption. III. (MME.) A. VASSY and E. VASSY (J. Phys. Radium, 1939, [vii], **10**, 459—464; cf. A., 1939, I, 596).—Subtracting from the total atm. absorption the true absorption of the gases constituting the atm. and the absorption due to mol. diffusion leaves the residual absorption; this is due to absorption by aerosols and is composed of two different types of absorption, one neutral and the other selective. The latter may have two entirely different natures, which at times co-exist. From a consideration of theory and of experimental observations, an attempt has been made to establish the origin of these different types of absorption. W. R. A.

Light of the night sky. G. FRONGIA (Nuovo Cim., 1939, **16**, 360—387).—A survey of the spectroscopy of the subject. λλ, intensities, and origin of lines and bands are tabulated. O. J. W.

Theory of the Compton effect. II. E. GÓRA (Acta Phys. Polon., 1939, **7**, 374—390; cf. A., 1939, I, 51).—Mathematical. O. D. S.

Auger and secondary X-ray electrons from gold. R. L. MAYO and H. R. ROBINSON (Proc. Roy. Soc., 1939, **A**, **173**, 192—200).—The energies of the Auger electrons have been measured by means of the magnetic spectrograph, and are compared with the energy of X-ray electrons expelled by primary Au L-radiation from normal Au atoms. A new val. for h/e, $1{\cdot}380_6 \times 10^{-17}$, is deduced. G. D. P.

Neutralisation and ionisation of cæsium and potassium at thoriated tungsten. N. D. MORGULIS and M. P. BERNADINER (Mem. Phys. Kiev, 1939, **8**, 35—53).—A study of the phenomena of discharge or ionisation of K and Cs ions or atoms at Th-coated W wires gives evidence of the structural heterogeneity of the Th patches. Simple relations between the activity of the Th coating and the val. of the neutralisation or ionisation coeff. are derived. R. T.

Work functions of different faces of silver single crystals. H. E. FARNSWORTH and R. P. WINCH (Physical Rev., 1939, [ii], **56**, 1067; cf. A., 1931, 889).—The work functions (equilibrium vals.) of the (100) and (111) faces, determined photo-electrically after extended outgassing in vac., are 4·81 ± 0·01 and 4·75 ± 0·01 e.v., respectively. Subsequent vals. for

the (100) face were: after 2130 hr. at room temp. in vac., 4·65 e.v.; after 100 hr. additional heating, 4·79 e.v.; after 118 hr. further heating, 4·81 e.v. The val. for the (111) face was unchanged by 407 hr. additional heating. N. M. B.

Velocity of negative ions of some halogen salts. C. Tudor (Bull. Acad. Sci. Roumaine, 1936, **17**, 203—208).—Measurements of μ_A at low pressures with $CaCl_2$, $SrBr_2$, $SrCl_2$, and $BaCl_2$ using Thomson's method (Proc. Camb. Phil. Soc., 1899, **10**, 241) show that at 0·37—0·95 mm. the val. of $\mu_A \times P$ is const. and similar to that at 1 atm. for each salt. F. H.

Search for a short-range group of protons in the D–D reaction. F. E. Myers, R. D. Huntoon, C. G. Shull, and C. M. Crenshaw (Physical Rev., 1939, [ii], **56**, 1104—1106; cf. A., 1938, I, 427).—A thorough search at bombarding energies up to 300 ke.v., and at angles 36°, 97°, and 142° to the incident deuteron beam, gave no evidence for a short-range group. N. M. B.

Deuteron–deuteron, proton–helium, and deuteron–helium scattering. N. P. Heydenburg and R. B. Roberts (Physical Rev., 1939, [ii], **56**, 1092—1095).—Measurements of deuteron–deuteron scattering at angles 20—45° for incident deuteron energies of 832, 720, and 614 kv. give a ratio >1 for observed scattering to that predicted by classical theory, as modified by Mott for identity of particles. At 832 kv. the ratio increases from 1·28 at 15° to 3·98 at 45°, an anomaly consistent with the presence of a short-range repulsive force between particles in addition to the Coulomb force. The scattering of protons in He agreed with the Rutherford–Darwin scattering formula for 994-kv. protons in the angular range 20—45°. The scattering of deuterons in He, investigated at 657 and 880 kv., showed an anomaly increasing from ~1 at 20° to 4·4 at 75° and indicating an additional repulsive nuclear force. N. M. B.

Scattering of protons by protons. III. N. P. Heydenburg, L. R. Hafstad, and M. A. Tuve, (Physical Rev., 1939, [ii], **56**, 1078—1091; cf. A., 1938, I, 168).—Previous investigations were repeated with improved scattering apparatus. Results are in general agreement with former and with other available data. N. M. B.

Intermediate ions of the atmosphere. A. R. Hogg (Proc. Physical Soc., 1939, **51**, 1014—1027).—Investigations with a special Zeleny-type divided-electrode condenser show that the smaller nucleated ions in city air exist in separate groups with distinct mobilities varying with humidity in a way which indicates that the ions consist of droplets of H_2SO_4 and result from the aggregation of particles containing ~2200 mols. of acid or multiples thereof. The acid, before and after aggregation, is hydrated to an extent dependent on temp. and humidity of the atm. and on the radius of the droplet. N. M. B.

Photo-emission in Geiger–Müller counters. S. C. Curran and J. E. Strothers (Proc. Camb. Phil. Soc., 1939, **35**, 654—657).—A difference is indicated between internally and externally extinguished types of counter. A–EtOH and other fillings, as well as photo-emission from the counter walls, are discussed. L. J. J.

Temperature factor in diffraction of electrons. M. V. Pasischnik (Mem. Phys. Kiev, 1939, **8**, 3—16).—The temp. coeff. of diffraction of fast electrons, at 293—537° K., by Ni, Cu, Bi, Ag, and MgO is quantitatively equal to that found for *X*-rays (cf. Waller, A., 1927, 816). R. T.

Secondary emission from evaporated nickel and cobalt. D. E. Wooldridge (Physical Rev., 1939, [ii], **56**, 1062—1063).—Curves for secondary yield–primary energy agree well with those derived from the equation previously deduced (cf. A., 1939, I, 590). N. M. B.

Multiple scattering of fast electrons. N. L. Oleson *et al.* (Physical Rev., 1939, [ii], **56**, 1171; cf. A., 1939, I, 590).—A correction. N. M. B.

Mechanism of secondary electron emission. R. Suhrmann and W. Kundt (Naturwiss., 1939, **27**, 707; cf. A., 1939, I, 510).—The penetrating power of secondary electrons, and vals. of *S*/*P*, the secondary electron emission, have been measured for films of Be, Cu, and Ag, deposited at 83° K. The penetrating power in the disordered state is < in the ordered state, because rearrangement of the lattice structure in metallic films causes the formation of more emitting centres in the disordered state. The possibility that the emitting centres are atoms ionised by collision with electrons is considered. W. R. A.

Limiting densities and mol. wts. of oxygen, carbon dioxide, sulphur dioxide, and hydrogen sulphide. Atomic weights for carbon and sulphur. E. Moles, (Miss) T. Toral, and A. Escribano (Trans. Faraday Soc., 1939, **35**, 1439—1452).—The compressibilities of O_2, C_2H_4, SO_2, CO_2, and H_2S have been determined at $0°\pm0·001°$, and the limiting densities of the other gases relative to O_2 are deduced. The results lead to vals. of $12·007\pm0·0002$ and 32·063 for the at. wts. of C and S, respectively, in accord with the reduced physical vals. deduced from recent determinations of the abundance ratios of the isotopes. J. W. S.

Mass and stability of ^{14}C. E. Pollard (Physical Rev., 1939, [ii], **56**, 1168; cf. Bonner, A., 1936, 773).—C bombarded by 3-Me.v. deuterons from a cyclotron gave a small yield of protons of range $81·1\pm2·0$ cm. ascribed to the reaction $^{13}C + {}^2D \rightarrow {}^{14}C + {}^1H$. The energy change is +8·21 Me.v., and the mass deduced for ^{14}C is $14·00775\pm0·00025$. B bombarded by both Po and Th-*C*′ α-particles gave groups at 42·1 and 97·6 cm., ascribed to the reaction $^{11}B + {}^4He \rightarrow {}^{14}C + {}^1H$. The respective energy changes are +0·62 and +0·70 Me.v., and the mean val. leads to the ^{14}C mass val. $14·00797\pm0·00035$. Combining results, the val. for ^{14}C is $14·00780\pm0·00020$. It is likely that ^{14}C emits an electron with an energy of 0·3 Me.v. and has a half-life of several years. N. M. B.

Radium protection. E. H. Quimby (J. Appl. Physics, 1939, **10**, 604—608).—A summary of the precautions desirable in work with radioactive materials. L. J. J.

Absolute intensities of the β-lines of thorium-*B* + *C* + *C''* and the factor for the inner transition of γ-rays. A. Flammersfeld (Z. Physik, 1939, **114**, 227—244).—The intensities of β-lines in the spectrum of Th-*B* + *C* + *C''* were obtained, using a magnetic β-spectrograph, and the planimetrically determined areas for the lines compared with similar areas in the continuous spectrum. In the energy range 7—12 ke.v., four new lines have been found. The transition factors for the *A*, *F*, and *X* radiation obtained from measured line intensities are compared with those calc. from theory. L. G. G.

β- and γ-Radiations from the active deposit of thoron. R. Arnoult (Ann. Physique, 1939, [xi], **12**, 241—388).—An account of the determination of the abs. energy of a standard ray (*F*-ray of the transformation Th-$B \underset{\gamma}{\overset{\beta}{\rightarrow}}$ -*C*), the quant. study of the intensity of conversion groups, the continuous β-spectrum of the Th-*B* → -*C* transformation, and the determination of systems of nuclear energy levels. W. R. A.

γ-Ray measurement of radium. T. H. Oddie (Proc. Physical Soc., 1939, **51**, 905—931).—Using a two-stage bridge-type electrometer valve amplifier to measure the ionisation current produced in a cylindrical ionisation chamber lined with brass, the obliquity and absorption corrections for finding the true from the measured content of a rectilinear radioactive source were determined. Full data are tabulated for the effect on the corrections of various distance and thickness factors. Variations of mass absorption coeff. of the γ-rays with at. no. of the material of the container screen and with the thickness of the Pb filter are given. N. M. B.

Internal absorption of γ-rays in radium-beryllium neutron sources. L. F. Curtiss (J. Res. Nat. Bur. Stand., 1939, **23**, 617—619).—Measurements of the internal absorption of γ-rays from 1·237 g. of finely powdered Be + $RaSO_4$ (0·1397 g. of Ra), contained in a brass cylinder 8 mm. internal diameter, 24·5 mm. internal length, and with 1-mm. walls, is such that a correction of 5·1% must be applied in determining the Ra content of such a source from the γ-ray intensity. J. W. S.

Critical conditions in neutron multiplication. R. Peierls (Proc. Camb. Phil. Soc., 1939, **35**, 610—615).—Mathematical. L. J. J.

Resonance capture of slow neutrons and emission of γ-rays. I. Nonaka (Nature, 1939, **144**, 831—832).—The neutron resonance energies of nuclei that are not made radioactive by neutron capture have been determined by utilising the γ-rays emitted in the capture process itself. The intensity of the γ-rays produced by slow neutrons plotted against thickness of paraffin placed between the D + D neutron source and the detector shows max. representing resonance levels for Hg, Cd, and Bi. Fe has no distinct resonance groups. L. S. T.

Low-energy neutrons emitted from beryllium bombarded with α-particles. M. Benini (R. C. Atti Accad. Lincei, 1939, [vi], **29**, 590—596).—Measurements with a modified coincident counter method confirm the presence of a low-energy band (~10^5 o.v.) in the energy spectrum of neutrons emitted from Po + Be. O. J. W.

Energy distribution and excitation function of neutrons from the transformation of lithium with α-rays. O. Haxel and E. Stuhlinger (Z. Physik, 1939, **114**, 178—184).—It is shown that the energy distribution of the emitted neutrons may be obtained from the excitation function for the slow neutrons produced in a nuclear transition. The ^{7}Li (α, *n*) ^{10}B transition is examined and energy levels for the ^{10}B nucleus found at 0·77, 1·32, and 2·09 Me.v. L. G. G.

Neutron spectra of the elements boron and beryllium on bombardment with α-rays. E. Stuhlinger (Z. Physik, 1939, **114**, 185—196; cf. preceding abstract).—The ^{11}B (α, *n*) ^{14}N and ^{9}Be (α, *n*) ^{12}C transitions are studied. The resonance levels for the intermediate nucleus ^{15}N are in excellent agreement with those obtained by Fünfer (cf. A., 1939, I, 349). L. G. G.

Pair emission in the proton bombardment of fluorine. J. R. Oppenheimer and J. S. Schwinger (Physical Rev., 1939, [ii], **56**, 1066—1067; cf. Fowler and Lauritsen, A., 1940, I, 4).—Mathematical. N. M. B.

Incorrect assignment of the supposed ^{27}Si radioactivity of 6·7-minute half-life. H. A. Bethe and W. J. Henderson (Physical Rev., 1939, [ii], **56**, 1060—1061).—Arguments against the assignment ^{27}Si to a positron activity (6·7 min.) produced by the reaction ^{24}Mg (α, *n*) are summarised. On bombardment of Mg with 16-Me.v. α-particles from a cyclotron, no positron activity was found but only negative electrons with upper limit ~2·5 Me.v. The correct assignment is ^{29}Al formed by the reaction ^{26}Mg (α, *p*) and the mass found for ^{29}Al is 28·9893. N. M. B.

Protons from (A) calcium, (B) vanadium, copper, manganese, and scandium under deuteron bombardment. W. L. Davidson, jun. (Physical Rev., 1939, [ii], **56**, 1061—1062).—(A) Absorption curves of protons from thick and thin targets of CaO bombarded by 3·1-Me.v. deuterons from a cyclotron show groups at 4·51 and 6·30 Me.v. attributed to Ca (*d*, *p*). The 4·51-Me.v. group is attributed to the reaction $^{40}Ca + {}^{2}H \rightarrow {}^{41}Ca + {}^{1}H$. The stability of ^{41}Ca is discussed (cf. Walke, A., 1937, I, 213; Nier, A., 1938, I, 168).

(B) Using 3·1-Me.v. deuterons, the reactions studied and the corresponding proton group energies (Me.v.) are: $^{51}V + {}^{2}H \rightarrow {}^{52}V + {}^{1}H$, (3·10, 5·33, 7·80); $^{63}Cu + {}^{2}H \rightarrow {}^{64}Cu + {}^{1}H$, (3·54, 4·35, 5·70); $^{65}Cu + {}^{2}H \rightarrow {}^{66}Cu + {}^{1}H$, (3·54, 4·35, 6·35); $^{55}Mn + {}^{2}H \rightarrow {}^{56}Mn + {}^{1}H$, (3·40, 4·62, 6·57); $^{45}Sc + {}^{2}H \rightarrow {}^{46}Sc + {}^{1}H$, (4·48, 6·78). The calc. mass. vals. are ^{52}V 51·9580±0·0013, ^{64}Cu 63·9572±0·0016, ^{66}Cu 65·9551±0·0016, ^{55}Mn 54·9643±0·0025, ^{46}Sc 45·9682±0·0013. N. M. B.

Radioactivity of ^{56}Mn. R. H. Bacon, E. N. Grisewood, and C. W. van der Merwe (Physical Rev., 1939, [ii], **56**, 1168; cf. Dunworth, A., 1939, I, 442).—The electrons ejected from a thin lamina fit an energy group having an extrapolated end-point between 1·50 and 1·75 mc^2, indicating a γ-ray line of 600—700 ke.v. Marked straggling to ~3·90 mc^2

may indicate a line at ~1·7 Me.v. The possibility of other lines between the two mentioned is discussed. N. M. B.

Nuclear isomerism in zinc. J. W. KENNEDY, G. T. SEABORG, and E. SEGRÈ (Physical Rev., 1939, [ii], **56**, 1095—1097; cf. A., 1939, I, 232). ^{69}Zn has two isomeric states differing by 0·47 Me.v. The upper state decays to the lower with a half-life of 13·8 hr., emitting a γ-ray which has an internal conversion coeff. <0·1. The lower state decays to ^{69}Ga with a half-life of 57 min. The most probable val. for the spin difference between the states is 5. N. M. B.

Radioactive isotopes of indium from α-bombardment of silver. L. D. P. KING and W. J. HENDERSON (Physical Rev., 1939, [ii], **56**, 1169).—Ag bombarded with 16-Me.v. α-particles gives a 20-min. period due to ^{112}In formed by the reaction ^{109}Ag (α, n) ^{112}In, and a 65-min. period due to ^{110}In by the reaction ^{107}Ag (α, n) ^{110}In. The former had previously been erroneously ascribed to ^{111}In (cf. Lawson, A., 1937, I, 594; Barnes, A., 1939, I, 592). A 72-sec. period may be due to ^{111}In but not to ^{114}In. Weak activities of ~9 hr. and 2—3 days are discussed. N. M. B.

β-Spectra of iodine. G. F. TAPE (Physical Rev., 1939, [ii], **56**, 965—971).—Momentum distributions of the β-particles emitted by I isotopes were examined in a large H_2-filled cloud chamber in a uniform magnetic field. Curves are given and end-points are compared with those extrapolated from Fermi and Konopinski–Uhlenbeck plots. γ-Radiation was found with each activity. Experimental β-ray energies are: ^{128}I (25±1 min.) 2·40±0·07, ^{120}I (13·0±0·3 days) 1·20 ±0·03, ^{131}I (8·2±0·3 days) 0·687±0·010, ^{130}I (12·5± 0·5 hr.) 0·83±0·03 Me.v. Estimated γ-ray energies are: ^{128}I and ^{126}I (?), ^{131}I 0·27 and 0·46, ^{130}I 0·59 Me.v. Fermi theory gives the better agreement with experiment. N. M. B.

Fission of protactinium. N. BOHR and J. A. WHEELER (Physical Rev., 1939, [ii], **56**, 1065—1066).—The production of fission by neutrons of energy <2 Me.v. but not by thermal neutrons (cf. Grosse, A., 1939, I, 546) is in agreement with the theory recently reported (cf. *ibid.*, 595). N. M. B.

New form of disintegration product of the uranium nucleus. V. G. CHLOPIN, M. A. PASNIK-CHLOPIN, and N. F. VOLKOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 665—667).—Na pyrouranate, after prolonged bombardment with slow neutrons, was freed from occluded Rn and air was then drawn over the salt and through SiO_2 gel at −110°. The gaseous disintegration product collected in the gel was extracted with dil. HCl and the solution mixed with dil. $BaCl_2$, $SrCl_2$, and $La(NO_3)_3$ solution. These metals were then separately pptd. as chromate, sulphate, and hydroxide respectively and the radioactivity of the ppts. was determined. The presence of activity in all three, and the half-life periods of the radio-elements concerned, show that radio-Xe and -Kr are secondary products of the U disintegration. L. G. G.

Fission of uranium under deuteron bombardment. D. H. T. GANT (Nature, 1939, **144**, 707).—Bombardment of U with high-energy deuterons affords evidence that radioactive nuclei with a range of ~2 cm. are projected from the target. The threshold for the deuteron-induced fission lies at ~8 Me.v., and the cross-section increases rapidly in the range 8—9 Me.v. L. S. T.

Delayed neutron emission accompanying uranium fission. K. J. BOSTRØM, J. KOCH, and T. LAURITSEN (Nature, 1939, **144**, 830—831).—In addition to the 12- and 45-sec. periods already known, periods of ~3 sec. and 0·1—0·3 sec. for the delayed neutron emission accompanying U fission have been detected. These results can be correlated with measurements (A., 1939, I, 398) on short β-ray periods from U fission, and can be explained by theoretical considerations put forward by Bohr and Wheeler (*ibid.*, 595). L. S. T.

Uranium and atomic power. R. D. ROBERTS and J. B. H. KUPER (J. Appl. Physics, 1939, **10**, 612—614).—A review of existing evidence indicating that the probability of economic application of energy released by fission of U nuclei by slow neutrons in a chain reaction is remote. L. J. J.

Interaction of fast neutrons with the uranium nucleus. L. GOLDSTEIN, A. ROGOZINSKI, and R. J. WALEN (J. Phys. Radium, 1939, [vii], **10**, 477—486).—The elastic and inelastic diffusion of fast neutrons (from Po + Be) by U has been investigated, using a H_2 ionisation chamber (at 35 atm. pressure). The possibility of applying this method to establish the liberation of neutrons from the rupture of the U nucleus bombarded by fast neutrons is discussed, and it is concluded that, although this type of rupture is possible, the nos. characterising this process cannot be defined unless definite knowledge is obtained on inelastic diffusion. The diffusion data indicate that reactions in branched chains, if at all possible, can be observed with very small amounts of U. W. R. A.

Existence and characteristics of absorbable ionising radiations emitted by common metals. J. A. REBOUL (J. Phys. Radium, 1939, [vii], **10**, 470—476).—The ionisation of air in a closed vessel can be explained by assuming that the metal of the walls of the vessel emits easily absorbable ionising radiations under the action of cosmic rays (cf. A., 1939, I, 297). This emission has been correlated with the intensity of cosmic irradiation as a result of experiment, and different ordinary metals (Sn, Pb, Fe, Cu, Zn, Ni, Al) have been compared from this viewpoint. The absorption coeff. of these radiations for air and Al has been experimentally determined, and their λ are deduced. W. R. A.

Neutrons in cosmic rays. G. COCCONI and V. TONGIORGI (Naturwiss., 1939, **27**, 740—741).—To discover the existence of neutrons in cosmic rays, the effect of the rays on saturated aq. $KMnO_4$, from which radio-Mn (half-life 2·5 hr.) would be produced by neutrons, was investigated. Experiments were carried out at heights of 120, 2000, and 3500 m., but in no case could neutrons be detected. A. J. M.

Allowed directions of cosmic rays as an existence problem of mathematical analysis. I. OPATOWSKI (Science, 1939, **90**, 463—464). L. S. T.

Air mass effect on cosmic-ray intensity. D. H. LOUGHRIDGE and P. GAST (Physical Rev., 1939, [ii], **56**, 1169—1170; cf. Blackett, A., 1939, I, 55).—Data were obtained indicating a marked change in intensity at the fronts separating different air masses. Results are explained mathematically. N. M. B.

World-wide variations of the earth's magnetic field and the intensity of cosmic radiation. O. GODART (Physical Rev., 1939, [ii], **56**, 1074—1077).—Mathematical. It is suggested that the principal part of the fluctuations of the earth's magnetic field, correlated with changes in the intensity of cosmic radiation, is due to intensity variations of the ionospheric currents. Quant. agreement with experiment is deduced. N. M. B.

Changes of intensity and composition of cosmic rays with magnetic latitude. P. AUGER, R. GRÉGOIRE, R. MAZE, and B. GOLDSCHMIDT (Compt. rend., 1939, **209**, 794—797).—Counter measurements on voyages between latitudes 40° N. and 38° S. confirm that the ratio of mesotrons to electrons remains accurately const., and thus support the theory that cosmic electrons result from decomp. of mesotrons. The variation of the no. of showers with latitude is $\ll$ that of the no. of single particles. A. J. E. W.

Intensity of mesotrons in the upper atmosphere. E. G. DYMOND (Nature, 1939, **144**, 782).—The intensity of vertically-directed mesotrons, measured with shielded coincidence counters in balloon flights, rises to a max. at $\sim$80 mm. pressure (16 km. height). The val. at this height is $\sim$ nine times the ground level val. (cf. A., 1939, I, 445), but the true increase is probably $<$ this. The discrepancy between this val. and the theoretical intensity variations deduced by Euler and Heisenberg can be removed by assuming a min. energy of mesotron production of $\sim$800 Me.v. L. S. T.

Investigations of comic-ray showers of atmospheric origin, using two cloud chambers. A. C. B. LOVELL and J. G. WILSON (Nature, 1939, **144**, 863—864).—The occurrence of large cosmic-ray showers originating high in the atm., and their transition behaviour in Al and Pb, have been investigated using two simultaneously operated cloud chambers. In Pb and in Al, large showers are the product of only a slight multiplication of pre-existing shower groups (A., 1936, 658). In the light elements, large showers will be relatively more frequent than is indicated by the cascade theory applied to a single entrant particle. L. S. T.

Cosmic-ray observations in the stratosphere with high-speed counters. L. F. CURTISS, A. V. ASTIN, L. L. STOCKMANN, and B. W. BROWN (J. Res. Nat. Bur. Stand., 1939, **23**, 585—595).—Using a Neher–Harper circuit in conjunction with large Geiger–Müller counters, it has been found that the max. cosmic ray intensity is 0·55% of that obtained from 1 mg. of Ra at a distance of 1 m., and occurs at an atm. pressure of 60 millibars. The very low intensity at 5 millibars previously recorded (Physical Rev., 1938, **53**, 23) could not be confirmed. J. W. S.

Schremp's theory of cosmic ray fine structure. H. S. RIBNER (Physical Rev., 1939, [ii], **56**, 1069—1073).—A search for an anomalous directional intensity pattern in the sky gave a directional intensity–zenith angle (z) curve indicating symmetrical prominences at $z = \pm 20°$ and probably others at $z = \pm 10°$ and $\pm 40°$ (cf. Cooper, A., 1939, I, 445). N. M. B.

Origin of cosmic radiation. H. ALFVÉN (Physical Rev., 1939, [ii], **56**, 1060).—A reply to Sabato (cf. A., 1939, I, 444). N. M. B.

Cosmic rays. P. M. S. BLACKETT (J. Inst. Elect. Eng., 1939, **85**, 681—684).—A lecture.

Decay of penetrating cosmic rays. II. E. M. BRUINS (Proc. K. Akad. Wetensch. Amsterdam, 1939, **42**, 740—744; cf. A., 1939, I, 175).—Theoretical. O. D. S.

Heavy electron and cosmic rays. G. BERNARDINI (Nuovo Cim., 1939, **16**, 262—268).—Historical. O. J. W.

Production of bursts and the spin of the meson. H. J. BHABHA, H. CARMICHAEL, and C. N. CHOU (Proc. Indian Acad. Sci., 1939, **10**, **A**, 221—223).—Theoretical. The meson has a spin of 1 unit. W. R. A.

β-Decay and mesotron lifetime. R SERBER (Physical Rev., 1939, [ii], **56**, 1065).—Mathematical. Difficulties arising in Yukawa's theory, if the mesotron is assumed to have spin one, are examined. N. M. B.

Neutral mesotrons and electron pairs. J. SOLOMON (Compt. rend., 1939, **209**, 678—680).—Theoretical. Gamow and Teller's theory of nuclear forces (A., 1937, I, 214) is included in the generalised theory of the neutral mesotron. A. J. E. W.

Absorption of slow mesotrons in matter. H. YUKAWA and T. OKAYAMA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 385—389).—It is confirmed mathematically that in the passage through a dense medium the capture by a nucleus takes place after the mesotron has been brought to rest, whilst in a gaseous medium spontaneous disintegration occurs before the mesotron has completely stopped. In Pb the mesotron is absorbed in $\sim 10^{-8}$ sec. D. F. R.

Electric quadrupole and magnetic dipole moments of ^{6}Li and ^{14}N. M. E. ROSE (Physical Rev., 1939, [ii], **56**, 1064).—The discrepancies between calc. and observed nuclear magnetic moments are examined with reference to the non-spherically symmetric nuclear forces invoked to account for the existence of the electric quadrupole moment of the deuteron (cf. A., 1937, I, 435). As a consequence of the angular dependence of the forces an electric quadrupole moment should be expected for ^{6}Li and ^{14}N and approx. vals. are deduced. N. M. B.

Limits of validity of quantum mechanics. G. WATAGHIN (Nature, 1939, **144**, 754).—Theoretical. L. S. T.

Exchange force between three heavy particles due to the meson exchange field. L. JÁNOSSY (Proc. Camb. Phil. Soc., 1939, **35**, 616—621).—Mathematical. The second-order approximation for the exchange potential between three heavy particles, involving emission and subsequent absorption of two mesons, is considered. L. J. J.

The particle aspect of meson theory. N. KEMMER (Proc. Roy. Soc., 1939, **A**, **173**, 91—116).—An aspect of the meson equations is developed in which the similarity to Dirac's equation of the electron is emphasised. The equations are of the Dirac type but involve matrices obeying a different scheme of commutation rules. The algebraic properties of these matrices are studied in detail, and a comparison with other formulations is given. G. D. P.

Self-consistent field with exchange for carbon. A. JUCYS (Proc. Roy. Soc., 1939, **A**, **173**, 59—67).—Solutions of Fock's equations have been obtained for the normal states of C^{+4} and C^{++}, and for all three configurations arising from the normal configuration of neutral C. Tables of wave functions and energies are given. G. D. P.

Theory of the proton. F. J. WIŚNIEWSKI (Acta Phys. Polon., 1939, **7**, 310—317).—Mathematical. On the hypotheses that the proton is composed of a positron revolving about a neutron and that the particles attract each other with a force inversely $\propto$ the fourth power of their distance and $\propto$ the product of their mases, a model is constructed from which vals. for the magnetic moments of the proton, the neutron, and the deuteron in accordance with experimental vals. may be calc. O. D. S.

Binding energy of ^{3}H. F. W. BROWN (Physical Rev., 1939, [ii], **56**, 1107—1110).—Mathematical. A calculation of the consts. in the meson type of potential is made. N. M. B.

Scattering of light in Bose–Einstein and Fermi–Dirac gas. B. N. SINGH (Phil. Mag., 1939, [vii], **28**, 635—641).—Mathematical. In non-degeneracy the effects of Bose–Einstein and of Fermi–Dirac statistics are respectively to increase and to decrease the scattering coeffs. as compared with the classical vals., and in degeneracy the scatterings tend respectively to infinity and to zero. F. J. G.

Physical processes in the gaseous nebulæ. VII. Transfer of radiation in the Lyman continuum. J. G. BAKER, L. H. ALLER, and D. H. MENZEL (Astrophys. J., 1939, **90**, 271—280; cf. A., 1939, I, 501).—Theoretical. L. S. T.

Measurements of the velocity of light. (A) (LORD) KITCHENER. (B) M. E. J. GHEURY DE BRAY (Nature, 1939, **144**, 945; cf. A., 1939, I, 589).—(A) Assuming that ***h*** and the energy given out by an excited atom remain unchanged, a change in ***c*** is inconsistent with the observed constancy of the λ of the red Ca line. Unsuspected systematic errors in the determinations of ***c*** are probable.

(B) A reply to the above. The decrease in ***c*** deduced from the red shifts is $\sim$1 in 6 $\times$ 10^8 for 30 years, which is not inconsistent with the apparent constancy of the red Ca line. The data given previously (*loc. cit.*) cannot be dismissed on the ground of unsuspected systematic errors. L. S. T.

λ 3400 bands of PH and PD. M. ISHAQUE and R. W. B. PEARSE (Proc. Roy. Soc., 1939, **A**, **173**, 265—277).—The band of PD analogous to the λ 3400 band of PH has been photographed and analysed. A catalogue of wave nos., intensities, and classification has been deposited in the archives of the Royal Society. G. D. P.

Spectrum of rubidium hydride, RbH. I. Analysis. II. Potential curves, wave functions, and intensity distribution. A. G. GAYDON and R. W. B. PEARSE (Proc. Roy. Soc., 1939, **A**, **173**, 28—37, 37—47; cf. A., 1938, I, 491).—I. The spectrum was photographed in the λ range 4600—6600 A., and a rotational and vibrational analysis was made. The spectrum is of the many-line type characteristic of the alkali hydrides.

II. The intensity distribution is described; in addition to the normal Frank–Condon parabola there are subsidiary parabolæ the presence of which is accounted for by a wave-mechanical treatment. Good agreement with the observations is obtained. G. D. P.

Binding of stoicheiometrical excess of sodium in sodium chloride crystals containing strontium chloride. H. PICK (Z. Physik, 1939, **114**, 127—132).—NaCl crystals containing $SrCl_2$ and excess of Na exhibit two new types of at. binding detectable by the absorption spectra at low temp. The new bands are due to the Sr. L. G. G.

Ultra-violet luminescence of sodium chloride crystals irradiated with *X*-rays at liquid air temperatures. M. L. KATZ and R. E. SOLOMONIUK (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 683—686).—The ultra-violet luminescence spectra excited by *X*-rays in naturally plastically deformed, tempered, and tempered and plastically deformed rock-salt crystals are measured by means of a quartz monochromator and photon counter. The bands are given, and their causes discussed. L. G. G.

Ultra-violet band system of carbon monoselenide. R. F. BARROW (Proc. Physical Soc., 1939, **51**, 989—991).—The system was produced in a heavy-current uncondensed discharge through a Si tube containing traces of a mixture of Al, Se, and a hydrocarbon grease. Accurate consts. are derived from measurements of 12 heads in the region λλ 2760—3054, and an expression for the heads is obtained. The vibrational coeffs. of this expression, and the estimated val. 6·8 e.v. of the dissociation energy of the ground state of CSe, are satisfactorily related to those of CO, CS, and SiSe (cf. A., 1939, I, 238). Attempts to develop the corresponding system of CTe were unsuccessful. N. M. B.

Application of the new analysis of molecular spectra to some interesting molecules. Simple relation between frequencies of the same molecule in the gaseous and liquid states. H. DESLANDRES (Compt. rend., 1939, **209**, 865—869; cf. A., 1940, I, 8).—The author's analysis is applied to Raman νν for gaseous and liquid SiH_4, NH_3, HCl, DCl, C_2H_2, and C_2D_2, and for liquid and solid S. In general the principal ν for the liquid is slightly $<$ that for the vapour, and the difference is related to the no. of electrons in the mol. A. J. E. W.

Absorption spectra of vapours in presence of a foreign gas. M. KANTZER (Compt. rend., 1939, **209**, 675).—Progressive addition of H_2, N_2, O_2, or

CO_2 to ICl vapour (pressure $p > 0{\cdot}1$ mm.) increases the absorption coeff. (α) to a limiting val. which depends on the gas added. With $p < 0{\cdot}1$ mm. α rises to a max. and then falls to a limiting val., both depending on the gas. A. J. E. W.

Absorption spectra of some substituted nitrosobenzenes. Evidence for mesomeric effect. H. H. HODGSON (J.C.S., 1939, 1807).—The absorption spectra of PhNO (I) and its *o*-OEt-, -I-, -Br-, and -Cl-substitution derivatives have been determined in alcoholic solution (cf. A., 1937, II, 251). Relative to (I) the shifts of the absorption bands of the *o*-halogeno-derivatives are in the order of the negative inductive effects of the halogens (I < Br < Cl). The displacement differences are small and appear to indicate the existence of positive mesomeric effects in the order Cl > Br > I (cf. Baddeley *et al.*, A., 1936, 165), which are not, however, > the negative inductive effects. In the case of the *o*-OEt-derivative the feeble negative inductive effect of the OEt group is $\ll$ the positive mesomeric effect. A. J. M.

Absorption spectra. H. TINTEA and P. POGÂNGEANU (Bull. Acad. Sci. Roumaine, 1938, **20**, 96—99).—Extinction curves and spectrograms for anthracene and pyrene are reproduced. The $\lambda\lambda$ at max. can be determined more accurately by means of the Hartley–Baly method than from extinction coeffs. C. R. H.

Ultra-violet absorption spectra of latent mosaic and ring-spot viruses and of their nucleic acid and protein components.—See A., 1939, III, 1105.

Colour of dyes. L. PAULING (Proc. Nat. Acad. Sci., 1939, **25**, 577—582).—A theory of colour based on the resonance of electric charge between atoms of the dye mols. has been developed which allows the frequencies and intensities of the absorption bands of dyes to be approx. calc. The band of longest λ, representing the transition from the normal state with nodeless wave-function to the excited state with a wave-function (or two wave-functions for degeneracy) with a single nodal plane, is predicted to be the most intense band for many dyes. The theory is discussed in relation to the resonating structures of benzaurin, various ketones, acridine-yellow, picric acid (I), etc. The predicted and observed vals. of the integrated absorption coeff. agree. The formation of mol. compounds between (I) and hydrocarbons and the influence on the colour of (I) is discussed. W. R. A.

Far infra-red absorption spectrum and the rotational structure of the heavy water vapour molecule. N. FUSON, H. M. RANDALL, and D. M. DENNISON (Physical Rev., 1939, [ii], **56**, 982—1000; cf. A., 1937, I, 495).—Using a large-aperture self-recording grating spectrograph, the spectrum of D_2O was investigated from 23 to 135 μ. Data and relative intensities of 210 pure rotation absorption frequencies are tabulated. The energy levels up to $j = 11$ of a zero-order approximation to the D_2O asymmetric rotator mol. were computed and corr. for zero point vibration and centrifugal stretching in the ground state. These levels corr. to fit the positions and intensities of the experimental data give 111 distinct energy levels. N. M. B.

Fundamental rotation–vibration band of nitric oxide. R. H. GILLETTE and E. H. EYSTER (Physical Rev., 1939, [ii], **56**, 1113—1119).—Measurements at high dispersion with an echellette grating spectrometer and a complete analysis are reported. Resulting consts. combined with those derived from existing electronic data give the following mol. consts. for the normal state of the mol.: $\omega_e = 1904{\cdot}03$ ($^2\Pi_{1/2}$), $1903{\cdot}68$ ($^2\Pi_{3/2}$) cm.$^{-1}$, $\omega_e x_e = 13{\cdot}97$ cm.$^{-1}$, $\omega_e y_e = -1{\cdot}20 \times 10^{-3}$ cm.$^{-1}$, $B_e = 1{\cdot}7046$ cm.$^{-1}$, $I_e = 16{\cdot}423 \times 10^{-40}$ g. sq. cm., $r_e = 1{\cdot}1508$ A. N. M. B.

Infra-red absorption spectra of arsine, deuteroarsine, and deuterophosphine. E. LEE and C. K. WU (Trans. Faraday Soc., 1939, **35**, 1366—1373).—The infra-red absorption spectra of gaseous AsH_3, AsD_3, and PD_3 have been studied over the ν range 500—2500 cm.$^{-1}$ Comparison of the observed and calc. vals. of the absorption frequencies indicates that the valency force field represents the actual intramol. forces. Detailed study of the 2120 cm.$^{-1}$ band of AsH_3 indicates that $I_A = 7{\cdot}43 \times 10^{-40}$ g.-cm.^{2} J. W. S.

Infra-red absorption of phenolic compounds. M. M. DAVIES (Trans. Faraday Soc., 1938, **34**, 1427—1429).—Measurements on o-$C_6H_4Cl{\cdot}OH$ and o-$C_6H_4(OH)_2$ substantiate the new cases of *cis–trans* isomerism postulated by Pauling (A., 1936, 718). F. L. U.

Frequency of the hydroxyl group in binary mixtures. III. Combination spectra of solutions of methyl alcohol in benzene, chlorobenzene, fluorobenzene, acetone, dioxan, ethyl ether, *iso*amyl ether, pyridine, and piperidine. V. I. MALISHEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 676—679; cf. A., 1939, I, 249).—The solvents containing O and N give rise to association bands with max. at 3520 and 3406 cm.$^{-1}$ respectively, whereas the benzenoid solvents only widen and displace the MeOH vapour line (3672 cm.$^{-1}$) to about 3630 cm.$^{-1}$ To avoid self-association the concns. of the solutions were $\not> 10\%$; the bands may therefore be ascribed to H-bond formation. L. G. G.

Molecular associations of cholesterol from absorption spectra in the near infra-red. (MLLE.) C. STORA and R. FREYMANN (Compt. rend., 1939, **209**, 752—754).—Intensity measurements on the second harmonic of the non-associated OH band at $\sim 0{\cdot}96\ \mu$. show that cholesterol (I) is associated more or less in the fused state (150°) and in $CHCl_3$, CCl_4, and C_6H_6; marked association also occurs between mols. of (I) and Et_2O, $COMe_2$, NH_2Ph, or $NPhMe_2$. Ovolecithin in $CHCl_3$ or CCl_4 gives no OH band, and does not associate with (I) in CCl_4. A. J. E. W.

Occurrence of overtone lines in Raman effect. S. BHAGAVANTAM (Proc. Indian Acad. Sci., 1939, **10**, **A**, 224—228).—Theoretical. For HCl, HBr, H_2, N_2, and O_2 the intensity of the fundamental is 150—500 times that of the overtone. W. R. A.

Continuous wings occurring in Raman effect. K. BAPAYYA (Proc. Indian Acad. Sci., 1939, **10**, **A**, 253—261; cf. A., 1939, I, 403).—Using exposures of a duration which will give identical peak intensity vals. for the 4358 A. Hg line when scattered by C_6H_6 and

*cyclo*hexane (I), the intensity of the wing obtained with C_6H_6 is > that with (I) and similarly for the horizontal components of the scattered radiation of both. The horizontal component of the wing in (I) is > that for AcOH although the optical anisotropy is less. AcOH and C_6H_6 have approx. the same optical anisotropy but the intensity of the wing in AcOH is ≪ that in C_6H_6, owing possibly to mol. association in AcOH. The absence of a max. separated from the centre of the liquid wing at temp. up to 200° is established. The appearance in the neighbourhood of the Rayleigh line of discrete lines in solids, continuous wings in liquids, and rotational Raman effect in gases is considered to be one comprehensive phenomenon arising from relative differences in thermal movements of mols. W. R. A.

Raman spectra of fused nitrates. P. A. MOSES (Proc. Indian Acad. Sci., 1939, **10**, A, 71—76).—The Raman spectra of fused $NaNO_3$, KNO_3, and $Al(NO_3)_3$ have been obtained. The depolarisation factors of the various lines are given and discussed. The overtone at 1660 cm.$^{-1}$ is recorded for the first time. For $NaNO_3$ the distribution of intensity in the wing accompanying the Rayleigh scattering of the 4047 A. Hg line has been studied. W. R. A.

Raman and infra-red spectra of uranyl salts. Structure of the uranyl group. G. K. T. CONN and C. K. WU (Trans. Faraday Soc., 1938, **34**, 1483—1492).—Raman spectra of aq. solutions of $UO_2(NO_3)_2$, UO_2Cl_2, and UO_2SO_4, and infra-red absorption spectra (4—14 μ.) of cryst. UO_2Cl_2 and $UO_2(OAc)_2$ have been determined. No certain inference can be made regarding the vertex angle of $UO_2^{\cdot\cdot}$. F. L. U.

Werner complexes. Raman spectra of tetra- and hexa-co-ordinated complexes. I. Chlorides, cyanides, and nitrites. J. P. MATHIEU and S. CORNEVIN (J. Chim. phys., 1939, **36**, 271—279).—Data are recorded for the Raman spectra of the following: H_2SnCl_6, $K_2Zn(CN)_4$, $Na_2Ni(CN)_4$, $Na_2Pd(CN)_4$, $Na_2Pt(CN)_4$, $K_3Fe(CN)_6$, $K_4Fe(CN)_6$, $K_3Co(CN)_6$, $K_3Rh(CN)_6$, $K_3Ir(CN)_6$, $Na_2Pt(NO_2)_4$, $Na_2Pd(NO_2)_4$, $Na_3Rh(NO_2)_6$, $Na_3Ir(NO_2)_6$. An improved arrangement for measuring the depolarisation factor of the Raman lines is described (cf. A., 1937, I, 394). F. L. U.

Raman effect and chemical constitution. Influence of constitutive and other factors on the double bonds in organic compounds. II. Effect of the phenyl group on the carbonyl bond in esters. G. V. L. N. MURTY and T. R. SESHADRI (Proc. Indian Acad. Sci., 1939, **10**, A, 307—316; cf. A., 1939, I, 121).—The Raman spectra of PhOBz, Ph cinnamate, and PhOAc are recorded and compared with those of Me and Et esters. The C:O frequency (ν) in Ph esters is ~20 —30 cm.$^{-1}$ > in alkyl esters. ν for esters of BzOH is < that for the corresponding esters of aliphatic acids. When Ph is attached to the C of a C:O group ν is lowered. An explanation of the changes in val. of ν, based on electromeric polarisation and resonance, is advanced. W. R. A.

Physico-chemical study of the ozonides of ethyl cinnamate and styrene. Raman spectra, ultra-violet absorption, heat of ozonisation, dielectric constant, and dipole moment. E. BRINER, A. GELBERT, and F. PERROTTET (Helv. Chim. Acta, 1939, **22**, 1491—1496).—The Raman spectrum of the ozonide of Et cinnamate (I) is similar to that of other ozonides, but retains the intense 1628 cm.$^{-1}$ frequency due to the ethylenic linking. The ultraviolet absorption spectrum also accords with those of other ozonides. The heat of ozonisation of (I) is ~94 kg.-cal. per g.-mol. The similarity between the dipole moments of (I) and of its ozonide (1·84 and 2·00 D., respectively) indicates that the electrical symmetry is not changed by the addition of O_3. Attempts to make similar measurements with styrene ozonide have been unsuccessful owing to its instability. J. W. S.

Raman effect in fluorene. D. POŚWIAT (Acta Phys. Polon., 1939, **7**, 367—373).—The Raman spectrum excited by λ 4358 A. in a solution of fluorene in CS_2 has been measured and analysed. O. D. S.

Raman spectra of aluminium and arsenic trimethyls. F. FEHÉR and W. KOLB (Naturwiss., 1939, **27**, 615—616).—Raman spectra of $AlMe_3$ and $AsMe_3$ in the liquid state have been examined. If inner vibrations of the Me groups are discounted and the mols. treated as "tetratomic," six fundamental νν should characterise both possible symmetry models, D_{3h} or C_{3v}, and spectroscopic activities of both models are discussed. Both mols. give seven lines not assignable to Me. The pyramidal (C_{3v}) model, which requires four Raman-active νν, is favoured. The appearance of two of the extra lines is due possibly to breakdown of selection rules in respect of the liquid state or to rotation of Me. The seventh line is attributed to either Fermi resonance or association. W. R. A.

Raman spectrum of trimethylaluminium ethyl etherate. F. FEHÉR and W. KOLB (Naturwiss., 1939, **27**, 616).—Comparison of the Raman spectrum of $AlMe_3$ Et etherate (I), which has been investigated in the liquid state, with those of $AlMe_3$ and Et_2O shows that it is not additive and indicates that (I) is a mol. compound in which Et_2O mols. are bound very closely to Me groups. W. R. A.

Absorption and diffusion of light by turbid media. A. BOUTARIC (Bull. Acad. Sci. Roumaine, 1938, **20**, 12—22).—Photometric measurements of the absorption of light by suspensions of mastic and of the diffusion in a plane at right angles to the incident beam confirm the conclusion reached theoretically that $i/I_0 = Axe^{-Bx}$, where i/I_0 is the ratio of the intensities of the diffused and incident light, x is the coeff. of absorption of the suspension, and A and B are consts. characteristic of the apparatus. F. H.

Infra-red radiations; quenching effects on zinc sulphide phosphors. G. G. BLAKE (J. Proc. Roy. Soc. New South Wales, 1939, **73**, 112—124).—The quenching effect of infra-red radiation of λ 0·4—>7 μ. on ZnS, ZnS–Cu, and CuS phosphors during and after illumination with visible light causing fluorescence has been studied. Quenching is more marked after removal of the exciting radiation. Phosphorescent emission increases with the temp. of the phosphor. A photographic process employing the effects observed is suggested. L. J. J.

Total light intensity from mixed phosphors. P. BRAUER (Z. Physik, 1939, **114**, 245—250).—An apparatus is described for measuring the intensity of phosphorescence of a mixed phosphor in terms of the separate intensities of each luminescent component, and its use exemplified in the case of CaO–Sm–Pr mixed phosphor. L. G. G.

Chemiluminescence of luminol. E. S. WASSERMAN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 704—706).—The effect of p_H on the $Co^{\cdot\cdot}$-catalysed luminescence of 3-aminophthalhydrazide during oxidation with H_2O_2 is examined. L. G. G.

Effect of temperature and exposure to *X*-rays on triboluminescence. F. G. WICK (J. Opt. Soc. Amer., 1939, **29**, 407—412).—The effect of exposure to *X*-rays at room temp. and liquid air temp. on triboluminescent emission of fluorite, sphalerite, kunzite, quartz, and U nitrate when ground at temp. between 60° and liquid air temp. resembles that of exposure to Ra. Temp. max. of triboluminescence are associated with phosphorescence and thermoluminescence max. at slightly higher temp. L. J. J.

Determination of the sensitivity of a photon counter. I. L. ROICH (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 687—689).—The spectral and abs. sensitivities of a Pt–H photon counter are determined, using black-body radiation and a quartz monochromator as energy source. The limit sensitivities (quanta cm.$^{-2}$ sec.$^{-1}$) are given for the range 2000—3200 A. L. G. G.

Excitation of oscillations by means of a dynatron in a circuit with uniformly distributed electrical constants. W. MAJEWSKI (Acta Phys. Polon., 1939, **7**, 340—356).—Mathematical. O. D. S.

Rectifying effect of semi-conductors with blocking layers. S. I. PEKAR (Mem. Phys. Kiev, 1939, **8**, 27—34).—Theoretical. The field formed in the blocking layer of a rectifying electrode favours diffusion of ions into the blocking layer only when a current is passing in the favoured direction. R. T.

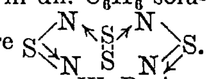
Secondary electron emission and charge phenomena in insulators. H. HINTENBERGER (Z. Physik, 1939, **114**, 98—109).—Conditions at the surfaces of insulators (mica, 4 μ. thick Al_2O_3, and NaCl) subjected to bombardment with electrons of variable velocity are examined. L. G. G.

Electrification of powders by free fall. G. MORRIS (Proc. Physical Soc., 1939, **51**, 1010—1013; cf. Fleming, A., 1939, I, 307).—Quant. investigation shows that for a given powder the quantity Q of electricity generated $\propto \sqrt{(hw)}$, where h = height of fall and w = wt. of powder. It is independent of the nature of the surface of the receiving vessel and of the capacitance of the measuring system. Under given conditions of fall, Q increases rapidly with increasing fineness of the powder. N. M. B.

Electrification by bubbling and dipole moment. G. LOVERA and A. POCHETTINO (Nuovo Cim., 1939, **16**, 337—347).—Measurements have been made of the amount of electrification produced by bubbling N_2 through solutions of *o*-, *m*-, and *p*-disubstituted aromatic compounds in non-polar solvents. Solutions of non-polar solutes produce no electrification, whereas with polar solutes the electrical charge produced increases with μ of the solute. O. J. W.

Electric strength of gases, measured by corona discharge. W. M. THORNTON (Phil. Mag., 1939, [vii], **28**, 666—678; cf. A., 1933, 332).—Max. corona-starting gradients (G) for a large no. of gases and vapours are given and compared with the electron mean free path (L). The gases fall into five groups, for each of which GL is const.; this suggests that the energy of ionisation by collision to start a spark discharge is const. in each group, and that the mol. areas of gases having the same electric strength, or the electric strengths of gases having the same mol. area, change only by finite and approx. equal steps. In the paraffin series addition of CH_2, or substitution of Cl for H, causes regular increases of strength. F. J. G.

Dielectric constants of ammonia, nitrogen, and carbon dioxide at ultra-high frequency. G. W. FOX and A. H. RYAN (Physical Rev., 1939, [ii], **56**, 1132—1136).—The heterodyne beat method was found to be satisfactory for determinations at 56 M-cycles in the temp. range 22—45°. Results for N_2 and NH_3 agree with those found at low frequencies. The val. for CO_2 rises anomalously from its normal val. to a max. at ~39° and then decreases. This variation is briefly discussed. N. M. B.

Constitution of sulphur nitride. N. L. PHALNIKAR and B. V. BHIDE (Current Sci., 1939, **8**, 473—474).—The dipole moment of S_4N_4 in dil. C_6H_6 solution is 0·72 D., indicating a structure 
W. R. A.

Dielectric constants of dipole liquids. C. J. F. BÖTTCHER (Chem. Weekblad., 1939, **36**, 803—806; cf. A., 1938, I, 436). S. C.

Electric moment of xanthates and of dithiocarbamates. I. Arsenic xanthates and dithiocarbamates. L. MALATESTA (Gazzetta, 1939, **69**, 629—639).—Measurements of d, n, and ϵ at 20° are recorded for solutions in C_6H_6 and in CS_2 of compounds of the types $(RO{\cdot}CS{\cdot}S)_3As$ and $(NR'_2{\cdot}CS{\cdot}S)_3As$, where R and R′ = Me, Et, Pr, Bu, and R also = C_6H_{11}. Vals of the polarisation and of μ are calc. O. J. W.

Dipole moments of certain compounds containing the carbonyl group. E. A. SCHOTT-LVOVA and J. K. SIRKIN (Acta Physicochim. U.R.S.S., 1939, **11**, 659—660).—To test the hypothesis that the large moments of certain aromatic compounds containing the CO group are due to resonance involving a large no. of internally ionised structures, the moment of benzanthrone (in C_6H_6 at 25°) has been determined and found to have the very large val. 3·49 D. Chloranil has an apparent moment ~0·86 D. F. J. G.

Dipole moments of phenyl iodo-dichloride and its derivatives. E. N. GURJANOVA and J. K. SIRKIN (Acta Physicochim. U.R.S.S., 1939, **11**, 657—658).—The following vals. for μ (in C_6H_6 at 25°) are recorded: $PhICl_2$, 2·61 D., *o*-$C_6H_4Me{\cdot}ICl_2$, 2·55 D., *m*-$C_6H_4Me{\cdot}ICl_2$, 2·82 D., *p*-$C_6H_4Me{\cdot}ICl_2$, 3·02 D., *o*-

$C_6H_4Cl{\cdot}ICl_2$, 2·95 D., m-$C_6H_4Cl{\cdot}ICl_2$, 2·11 D., p-$C_6H_4Cl{\cdot}ICl_2$, 1·3 D., m-C_6H_4ClI, 1·39 D., p-C_6H_4ClI, 0·46 D. The large vals. indicate resonance between homopolar and internally-ionised structures.

F. J. G.

Internal rotation and dipole moment in succinonitrile. G. L. LEWIS and C. P. SMYTH (J. Chem. Physics, 1939, **7**, 1085—1093).—Using an a.c.-operated heterodyne beat apparatus similar to that described by Stranathan (Rev. Sci. Instr., 1934, **5**, 334), the dipole moments of AcCN from −60° to 60° and of succinonitrile (I) from −90° to 90° in PhMe solution have been measured. The observed moments have been used to calculate the height of the potential barrier which restricts rotation around the C·C single linking in (I) and thus causes the moment of the mol. to increase with rising temp., assuming that each half of the (I) mol. has the same moment as the AcCN mol. The val. obtained, 1·2±0·5 kg.-cal., agrees well with the val. 1·5 kg.-cal. obtained by calculating the sum of the different potential energies existing between the two halves of the mol.

W. R. A.

Raman–Krishnan theory of the refractivity of liquids. S. S. RAO and M. QURESHI (J. Osmania Univ., 1937, **5**, 20—26).—The concept of the anisotropic polarisation field introduced by Raman and Krishnan (A., 1928, 348) has been examined in the light of the points raised by Darwin (A., 1934, 1157). Only for spherical mols. does the polarisation field $=4\pi P/3$, and for mols. of high asymmetry there are large deviations. n for C_5H_{12} vapour and for liquid C_6H_{14} and C_8H_{18} has been calc. from the Lorentz and Raman–Krishnan formulæ. The latter vals. are in excellent agreement with the observed vals.

W. R. A.

Magnetic rotatory dispersion and refractivity of aqueous solutions of nickel sulphate throughout the range 5780 A. to 2482 A.; magnetic rotation in the 3950 A. absorption band. R. W. ROBERTS and S. F. ADAMS (Phil. Mag., 1939, [vii], **28**, 601—613).—Verdet consts. and n vals. are given for aq. $NiSO_4$ over the range λ 5780—2482 A. The red and violet absorption bands are at 0·720 and 0·395 μ., respectively, and not at 0·690 and 0·405 μ. as previously stated (A., 1911, ii, 786). In the neighbourhood of the latter the dispersion of the magnetic rotation is asymmetric, as predicted by Gorter (A., 1933, 448).

F. J. G.

Magneto-chemical investigations. IV. Magneto-chemistry of complex antimony compounds of principal valency four. R. W. ASMUSSEN (Z. Elektrochem., 1939, **45**, 698—702).—Isomorphism and colour in Sb compounds give no conclusive evidence for the existence of Sb^{IV}. Experiments with radioactive Sb show that at. exchange occurs between $SbCl_3$ and $SbCl_5$ and between Rb_2SbCl_6 (or Rb_2SbBr_6) and $SbCl_3$ in HCl solution. Eight double salts supposed to contain Sb^{IV} are diamagnetic (as are Sb^{III} and Sb^{V}), although the Sb^{IV} atom should be paramagnetic. It is probable that the compounds contain alternate Sb^{III} and Sb^{V} atoms, although X-ray data indicate that all the Sb atoms are equiv.

A. J. E. W.

Active iron. XII. Magnetic characterisation of some complex iron salts. A. SIMON and H. KNAUER (Z. Elektrochem., 1939, **45**, 678—685).—[Fe dipy]Cl_3 has no catalytic activity, and cannot be converted directly into [Fe $dipy_3$]Cl_3; magnetic data and the energies of the electronic levels show that it is a mononuclear ion dipole complex, in spite of its high stability. [Fe phenan]Cl_3 is similar (dipy = 2 : 2′-dipyridyl, phenan = o-phenanthroline). The *salts* [Fe $dipy_3$]$_2$[$PtCl_6$]$_3$,0·7H_2O and [Fe $phenan_3$]$_2$[$PtCl_6$]$_3$,H_2O have been prepared by oxidation of corresponding $Fe^{\cdot\cdot}$ complexes with Cl_2; the magnetic data show that these are mononuclear penetration complexes, although they are very unstable and rapidly revert to the $Fe^{\cdot\cdot}$ salts. It is deduced that transition from the $3d^5$ state ($Fe^{\cdot\cdot\cdot}$) to $3d^64s$ or $3d^74s4p^3$ is relatively difficult, but transitions from $3d^6$ ($Fe^{\cdot\cdot}$) to $3d^84s4p^3$ and from this to $3d^74s4p^3$ are more easily effected. The Weiss law is obeyed by all the above compounds (Θ = 1—20°); the variation of Θ with the degree of hydration and other factors shows that Θ is determined by interaction between the central atom and the co-ordinating groups and H_2O mols.

A. J. E. W.

Quantum-mechanical basis of statistical mechanics. E. C. KEMBLE (Physical Rev., 1939, [ii], **56**, 1146—1164).—Mathematical. The fundamental theorems of a treatment of statistical mechanics previously reported (cf. A., 1940, I, 64) are developed, and the unsatisfactory features of Neumann's macroscopic entropy definition are examined. N. M. B.

Van der Waals potential in helium. H. MARGENAU (Physical Rev., 1939, [ii], **56**, 1000—1008; cf. A., 1931, 1216).—Mathematical. A variational method of investigating the additivity of first-order exchange and second-order van der Waals potentials shows that the assumption of additivity is entirely false for at. H but is almost legitimate for He and probably safe for heavier structures. Numerical vals. occurring in the attractive part of the potential are redetermined. It appears that the val. of the dipole–dipole coeff. in the Slater–Kirkwood formula has been too high. The final equation for the van der Waals potential seems consistent with determinations from empirical data.

N. M. B.

Intermolecular potential of mercury. J. H. HILDEBRAND, H. R. R. WAKEHAM, and R. N. BOYD (J. Chem. Physics, 1939, **7**, 1094—1096).—The intermol. potential of Hg has been calc. from the Hildebrand–Wood equation (A., 1934, 146) using the vals. of the distribution function for liquid Hg from the m.p. to 250° obtained previously (A., 1940, I, 12).

W. R. A.

Electron energy levels in sodium chloride. S. R. TIBBS (Trans. Faraday Soc., 1939, **35**, 471—1484).—Mathematical. Slater's extension of the Wigner and Seitz method (A., 1934, 828) is used to calculate the energy of the lowest conduction level in NaCl, and to determine the width of the first band of allowed conduction levels for the (100) direction. Attempts are made to ascribe to an electron at a vacant Cl′ ion lattice point wave functions which give rise to energy levels which are in accord with the experimental data on F-centres. J. W. S.

Dimensions of the phosphine and arsine molecules and the possibility of optically active derivatives. G. B. B. M. SUTHERLAND, E. LEE, and C. K. WU (Trans. Faraday Soc., 1939, **35**, 1373—1379).—From the vibrational frequencies of PH_3, PD_3, AsH_3, and AsD_3, and assuming a valency force field, the dimensions of the PH_3 and AsH_3 mols. have been deduced. These vals. indicate that the height of the barrier restricting the passage of the P atom through the plane of the H atoms is $\sim$2000 cm.$^{-1}$, approx. the same as in NH_3, but that the frequency of inversion is $\sim$0·001 of that in NH_3. It is considered possible that if large groups were substituted for the H atoms, mols. might be obtained for which the frequency of inversion would be sufficiently slow to permit the separation of optically active isomerides at low temp. J. W. S.

Potential energy relationships in normal and excited acetaldehyde. T. W. DAVIS and M. BURTON (J. Chem. Physics, 1939, **7**, 1075—1080).—The dependence on temp. and λ of the relative probabilities of the production of free radicals and ultimate mols. in the primary photochemical act, the disappearance of fluorescence at shorter $\lambda\lambda$ and at higher temp., the separate max. for band and continuous absorption, and the high quantum yield at 3340 A. have been explained by applying a modified extension of the system of potential energy hypersurfaces (A., 1939, I, 481) to correlate observations on the thermal and photochemical decomp. of MeCHO. W. R. A.

Modern quantum mechanics and the benzene problem. IV. G. ELSEN (Chem. Weekblad, 1939, **36**, 763—773; cf. A., 1937, I, 15).—The case of a single linking attached to a C atom is considered. D. R. D.

Rotation-vibration energies of tetrahedrally symmetric pentatomic molecules. II. W. H. SHAFFER, H. H. NIELSEN, and L. H. THOMAS (Physical Rev., 1939, [ii], **56**, 1051—1059; cf. A., 1940, I, 11).—Mathematical. A general discussion of a method for obtaining the first-order Coriolis splitting of the harmonic and combination states of ν_3 and ν_4 is given. The method is applied to obtain these splittings of $2\nu_3$, $2\nu_4$, and $\nu_3 + \nu_4$, and to derive the stabilised wave functions for these states and the selection rules. N. M. B.

Calculation of bond strengths. M. BURTON (J. Chem. Physics, 1939, **7**, 1072—1075).—The hypothesis (A., 1939, I, 62), that certain predissociation phenomena may be used to fix the strength of the bond involved in the associated photochemical act, has been re-examined and found to give incorrect conclusions. New vals. have been calc. for C–C and C–H bond strengths in C_2H_6, $COMe_2$, MeCHO, $(CHO)_2$, Ac, and in CH_4, CH_2O, MeCHO, and HCO respectively. These are self-consistent but exhibit slight variations due to secondary effects of adjacent double bonds. In free Ac and HCO radicals the bonds are much weaker than in the stable compounds. W. R. A.

Lengths of the links of unsaturated hydrocarbon molecules. C. A. COULSON (J. Chem. Physics, 1939, **7**, 1069—1071).—Assuming a simple interaction to exist between all contiguous C–C linkings, the lengths of the linkings in conjugated chain mols. $C_{2n}H_{2n+2}$ (n = 1 to 4) and in condensed aromatic hydrocarbons (C_6H_6, $C_{10}H_8$, and Ph_2) have been calc., and vals. agree with those obtained from application of quantum-mechanical conceptions of resonance. W. R. A.

Shape and character of thermal motion of long-chain organic molecules and elasticity of rubber-like substances. S. E. BRESLER and J. I. FRENKEL (Acta Physicochim. U.R.S.S., 1939, **11**, 485—504).—Theoretical. The theory of Mark and Huhn (A., 1935, 150; 1936, 1327, 1337) is based on free rotation about single bonds, and therefore cannot be valid since the work of Kistiakowsky and Pitzer (A., 1937, I, 398; 1939, I, 62, 362) shows that free rotation does not occur and must be replaced by torsional oscillations. In an analysis in which account is taken of the energy difference (U $\sim$3600 g.-cal.) between the *cis*- and *trans*-configurations, it is shown that the mean-square length ($\bar{\lambda}^2$) of a chain of n links of length l is given by $\bar{\lambda}^2 = l^2nU/[kT \times (1 - \cos\omega)]$, where ω is the complement to the valency angle. This implies that org. mols. of $\ngtr$ $\sim$20 links are almost rigid in solution, and in general that the difference between statistical and geometrical length, although large for very long chains, is $\ll$ in the Mark–Kuhn theory. The val. calc. on this basis for the elasticity modulus in terms of "kinetic elasticity" alone is $\sim$20 times too low, and the approx. agreement obtained by Kuhn is to be regarded as accidental. F. J. G.

Inertial effects in the skeletal vibrations of tetramethylmethane and tetramethylsilicon. S. SILVER (J. Chem. Physics, 1939, **7**, 1113).—The calculation of vibration $\nu\nu$ of CMe_4 and $SiMe_4$ by the method of Wall and Eddy (A., 1938, I, 178), when modified to take account of the masses of H in Me groups, gives satisfactory agreement with observed vals. W. R. A.

Nature of liquid state. W. BAND (J. Chem. Physics, 1939, **7**, 1114).—Van der Waals' forces build up a potential well within the liquid which can be smoothed out, leaving a potential wall at the boundary, and within this wall mols. are free to act as a gas of spheres of non-negligible size. Only mols. with kinetic energy > the height of the wall will contribute to the external pressure. Assuming van der Waals forces similar to those found by Lennard-Jones and Devonshire (A., 1938, I, 130), the mean potential per mol. will increase with temp. and for these forces there will be an optimum density at which the potential has greatest depth. If the mean potential per mol. for this optimum density just vanishes at $T°$, than at $> T$ the liquid cannot exist as a separate phase and at $< T$ it is always possible to find a density near enough to the optimum val. to form a potential well in which some mols. can be trapped by what is thus equiv. to an intrinsic pressure. From this viewpoint liquid–vapour change is consistent with Mayer's treatment (*ibid.*, 185) and with the clustering theory (*ibid.*, 358). The process of freezing is interpreted in terms of the theory and gives the picture of the cryst. state developed by Shockley (J. Appl. Physics, 1939, **10**, 543). W. R. A.

Inversion of the partition function to determine the density of energy states. S. H. BAUER (J. Chem. Physics, 1939, **7**, 1097—1102).—Mathematical. A general method for determining the density of energy states for a complex system is its deduction from thermodynamic functions when their temp.-dependence is specified. The accuracy of the method is determined by the accuracy with which the experimentally determined partition function can be represented by an appropriate equation, and this in turn depends on accurate sp. heat data. The method has been applied to the energy states for an Einstein crystal, and for a modified Debye crystal with and without a transition. W. R. A.

Surface tension of water and heavy water. A. H. COCKETT and A. FERGUSON (Phil. Mag., 1939, [vii], **28**, 685—693).—γ for ordinary H_2O and for 99·2% D_2O have been determined at 10—75°. The results are represented by $\gamma = 75{\cdot}23 - 0{\cdot}06667\theta^{1{\cdot}2}$ for H_2O and $\gamma = 74{\cdot}64 - 0{\cdot}1082\theta^{1{\cdot}1}$ for D_2O. By application of the Eötvos rule D_2O is less associated than H_2O. F. J. G.

Organic parachors. IV. Constitutive variations of the parachors of a series of *tert*. chlorides. O. R. QUAYLE, (MISS) K. OWEN, and E. M. BEAVERS (J. Amer. Chem. Soc., 1939, **61**, 3107—3111).—*d*, σ, and parachors for 16 *tert*.-alkyl chlorides decrease linearly with temp. (usually 0—65° or 25—75°). The effect of chain-branching on parachors is very similar to, but not identical with, that for the corresponding alcohols (cf. A., 1939, I, 304). R. S. C.

New applications of the parachor. P. BOGDAN (Bull. Acad. Sci. Roumaine, 1939, **22**, 104—108; cf. A., 1939, I, 455).—The val. of $\gamma V^{2/3}$ at the b.p., calc. from Sugden's $[P]$, is $> T$ for normal substances but $< T$ for OH-compounds. The crit. temp. (T_c), calc. from the relation $\gamma V^{2/3} = 2{\cdot}05(T_c - T)$, is $<$ the observed val. for associated substances. Determination of the "neoparachor" $[P_n]$ is shown to be sufficient to distinguish between the possible structural formulæ for the simpler compounds of empirical formula CH_2O. J. W. S.

Determination of the parachors of liquids and solids in solution. N. F. KOMSCHILOV (J. Gen. Chem. Russ., 1939, **9**, 1539—1545).—The parachor of substances dissolved in C_6H_6 or $CHCl_3$ is calc. from $P = M\gamma^{\frac{1}{4}}/D$. $M = M_a x + M_b(1 - x)$, where M_a and M_b are the mol. wt. of solute and solvent, respectively, and x is the mol. concn. of the solute; $\gamma = \{\gamma_m v_m^{2/3} - \gamma_b v_b^{2/3}(1 - x)\}/v_a^{2/3}x$, where γ_m and γ_b are the surface tension of solution and solvent, respectively, and v_m, v_a, and v_b are the mol. vol. of solution, solute, and solvent, respectively. D is the density of the solution. R. T.

Diffraction of X-rays by small crystalline particles. A. L. PATTERSON (Physical Rev., 1939, [ii], **56**, 972—977).—Mathematical. The problem is treated by Fourier analysis and is extended to the calculation of interference functions for any polyhedron. N. M. B.

Scherrer formula for X-ray particle size determination. A. L. PATTERSON (Physical Rev., 1939, [ii], **56**, 978—982; cf. preceding abstract).—Mathematical. An exact derivation of the Scherrer formula for spherical particles is given, and vals. of the const. for half-val. breadth and for integral breadth are obtained. Comparison with various approximation methods is made. N. M. B.

Structure of aluminium after compression. C. S. BARRETT and L. H. LEVENSON (Amer. Inst. Min. Met. Eng., Tech. Publ. 1104, 1939, 15 pp.; Met. Tech., 1939, **6**, No. 6).—The texture of Al at successive stages of compression was examined by optical reflexion and X-ray diffraction methods. A hitherto unsuspected range of orientations is present both in the polycryst. metal as a whole and in various individual grains in the interior, and a state of dynamic equilibrium exists within this range. All orientations are found except those having [111] within 20° of the axis of compression although the amount having [100] within 15° of the axis is very small. Individual grains do not rotate as units but become distorted with a range of orientation which increases with the deformation. R. B. C.

Influence of temperature on the intensity of Röntgen rays reflected from different planes of the zinc crystal. S. WROŃSKI (Acta Phys. Polon., 1939, **7**, 357—366).—The relative intensities of reflexion from different lattice planes of the Zn crystal have been measured at room temp. and 567° K. by the Debye–Scherrer method. At room temp. the amplitudes of heat oscillations of the Zn atom in the direction of and normal to the *c*-axis are calc. to be 0·127 and 0·0734 A. Calc. vals. for the characteristic temperature of Zn are $\Theta_{\parallel}$, 200° K., $\Theta_{\perp}$, 347° K. O. D. S.

X-Ray examination of titanium nitride. III. Investigation by the powder method. A. BRAGER (Acta Physicochim. U.R.S.S., 1939, **11**, 617—632; cf. A., 1940, I, 13).—Ti nitride prepared at $\nless$1600° has the composition TiN, with ρ 5·1 and *a* 4·235 A., and is brown or gold. As the temp. of prep. falls below ~1400°, the Ti content, ρ, and *a* all decrease, and at the same time the colour changes to blue-black. All preps. have the same (NaCl) crystal structure, but the low-temp. preps. have vacant spaces in the Ti lattice. On melting some dissociation occurs, affording a two-phase system, TiN + Ti. F. J. G.

Structure of the copper salts of some complex cyanides. II. Structure of copper manganese hexacyanide. M. A. ROLLIER and G. CESONI (Gazzetta, 1939, **69**, 674—679; cf. A., 1929, I, 600).—The prep. of thin films of $Cu_2Mn(CN)_6$ is described. X-Ray measurements show that this substance is cubic, space-group O_h^5, *a* 10·14 A., $Z = 4$. The val. of the ionic radius for CN is calc. to be 1·68 A. O. J. W.

Basicity of heteropoly-acids—a problem in structure. O. KRAUS (Naturwiss., 1939, **27**, 740; cf. A., 1939, I, 457).—A new Fe^{III} *silicotungstate*, $Fe_5HSi_2W_{24}O_{84},52H_2O$, has been obtained, in which the silicotungstic acid is at least octabasic. It forms deep yellow, tetragonal leaflets, fairly stable in air, but decomp. slowly in cold H_2O. It has *a* 12·18, *c* 18·82 A.; 1 mol. in unit cell, *d* 4·19. The crystals

are optically anomalous with mono- and bi-axial fields. The unit cell agrees in dimensions and form with that of $H_4SiW_{12}O_{40},30H_2O$. The anomalous optical and *X*-ray behaviour of the salt can be explained by the fact that the possession of more than 4 H per acid mol. is connected with a constraint which is exerted on the stability and symmetry of the mol. A. J. M.

X-Ray study of esters of polymetatelluric acid. M. Mathieu and (Mlle.) C. Stora (Compt. rend., 1939, **209**, 834—836).—Diffraction angles (θ), with the corresponding cell dimensions, are recorded for the principal rings given by H_2TeO_4 and its Me H, Et, Pr^{α}, Pr^{β}, Bu^{α}, Bu^{β}, *iso*amyl, and heptyl esters, using Cu $K\alpha$ radiation. θ varies regularly with the no. of C in the mol., except that $Pr^{\alpha}{}_2TeO_4$ is anomalous. A. J. E. W.

Crystal structure of di-*n*-propylmonocyanogold. R. F. Phillips and H. M. Powell (Proc. Roy. Soc., 1939, **A, 173**, 147—159).—*X*-Ray analysis shows that the crystals belong to the orthorhombic system, space-group *Pca*, *a* 17·06, *b* 22·36, *c* 10·0 A. There are 16 mols. of $AuPr_2 \cdot CN$ per cell; the true mol. contains 4 Au at the corner of a square linked by CN along each side. The four covalencies of $Au^{\cdots}$ are at right angles to each other and are coplanar, with a bond length of 1·3 A. G. D. P.

Constitution of cyano-derivatives of gold. C. S. Gibson (Proc. Roy. Soc., 1939, **A, 173**, 160—161).—The results of the preceding abstract make it possible to suggest constitutions for the products of decomp. of di-*n*-propylmonocyanogold, viz., di-*n*-propyldicyanodigold and Au^{I} cyanide. The former, it is suggested, is a zig-zag chain of alternate Au^{I} and Au^{III} atoms separated by C⋮N groups. Loss of Pr^{α} radicals produces a straight-chain structure for Au^{I} cyanide. G. D. P.

Crystal structure of *cyclo*hexane at −180°. K. Lonsdale and H. Smith (Phil. Mag., 1939, [vii], **28**, 614—616).—A powder photograph of *cyclo*hexane at −180° gives spacings, many of which do not correspond with those found by Hassel and Kringstad (A., 1931, 27) at −80°, nor with any cubic, hexagonal, or tetragonal lattice, suggesting the existence of a low-temp. modification having a low class of symmetry. F. J. G.

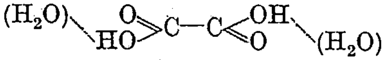
X-Ray photographic method for determining the submicroscopic fine structure of substances. The cellulose model. R. Hosemann (Z. Physik, 1939, **114**, 133—169; cf. A., 1940, I, 12).—Apparatus which operates on the principles previously laid down is described, and the structures of a paraffin $C_{31}H_{64}$ and a no. of cellulose fibres have been examined. The paraffin crystallites are flat plates about 400 A. thick and of breadth approaching macroscopic dimensions. The cellulose types, cellulose triacetate (I) and ramie, gave similar diagrams and indicate micelle lengths of 200 and 3000 A. respectively. Examination of the "coarsely-cryst." fully acetylated dextrin shows the micelles to exist chiefly at diameters of 60 A., the lack of thin micelles showing the non-fibre-like nature of the material. The aggregation diagrams for (I) confirm existing theories for the cellulose model. L. G. G.

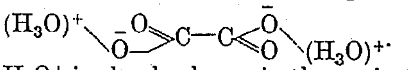
Optical demonstration of the diffraction of electrons. J. J. Trillat (J. Phys. Radium, 1939, [vii], **10**, 465—469).—An optical method has been devised by which electron diffraction diagrams can be materialised and presented to a large audience. The method also serves to test theoretical statements, and has been applied to the diffraction of electrons by metals. W. R. A.

Intensities of electron diffraction rings. M. Blackman (Proc. Roy. Soc., 1939, **A, 173**, 68—82).—The development of the dynamical theory shows that the kinematical theory is not in general applicable to the thin films used in work with fast electrons. An expression for the intensity of reflexion from a polycryst. film is obtained and compared with experimental data for Cu and Ag, for the case when the scattering is too large for the kinematical theory to apply. Good agreement is obtained. G. D. P.

Application of Fourier analysis to chemical linking. III. Binding in quartz. IV. Oxygen binding in oxalic acid dihydrate. R. Brill, C. Hermann, and C. Peters (Naturwiss., 1939, **27**, 676—677, 677—678; cf. A., 1939, I, 243).—III. The electron density in α-quartz projected on a plane containing the SiO link has been obtained. This link is intermediate between a homo- and a heteropolar link.

IV. A Fourier analysis of the *X*-ray data for $H_2C_2O_4,2H_2O$ has been carried out. The distance between the C atoms is > that found by Robertson *et al.* (A., 1937, I, 68). The results point to a resonance between the two structures

 and

 The presence of H_3O^+ is clearly shown in the projection diagram. A. J. M.

Investigation of chlorosilanes and of chloro- and bromo-acetylene by electron diffraction and electric dipole moment measurements on the vapours. L. O. Brockway and I. E. Coop (Trans. Faraday Soc., 1938, **34**, 1429—1439).—Si—Cl bond distances furnished by the electron diffraction measurements are: SiH_3Cl 2·06±0·05 A., SiH_2Cl_2 2·02±0·03 A., $SiHCl_3$ 2·01±0·03 A., and the Cl–Si–Cl angle of the two last is 110±1°. The corresponding dipole moments (μ) are 1·28, 1·17, and 0·85 D. Comparison with similar data for the chloromethanes shows that the lengths of the Si–Cl bonds are affected, not by the polarity, but by a degree of double bond character arising from back co-ordination of one of the unshared pairs of electrons on the Cl to the central atom. CH⋮CCl and CH⋮CBr have μ 0·44 and 0·00 D. respectively; these vals., small compared with those of the Me halides, lead to "mesomeric" moments of 1·6 and 2·0 D. The bond distances are 0·08 and 0·11 A. < in MeCl and MeBr. F. L. U.

Electron diffraction and electric dipole moment investigations of derivatives of ethylene.

J. A. C. HUGILL, I. E. COOP, and L. E. SUTTON (Trans. Faraday Soc., 1938, **34**, 1518—1534; cf. preceding abstract).—The following bond distances and angles have been determined: $CH_2{:}CHBr$ and *trans*-CHBr:CHBr (I), C—Br 1·86±0·04 A., Br–C–C 121±3°; (I), Br—Br 4·56±0·02 A.; $CH_2{:}CHI$ (II), *cis*- (III) and *trans*- (IV) -CHI:CHI, C—I 2·03±0·04 A., I–C–C [(II) and (III)] 122±2°, [(IV)] 125±2°, I—I [(III)] 3·69±0·02 A., [(IV)] 4·90±0·02 A. The data are discussed and considered to agree with the hypothesis that there is resonance between the normal and excited structures, $CH_2{:}CH{\cdot}X$ and $\bar{C}H_2{\cdot}CH{:}\overset{+}{X}$, the former being ~9 times as important as the latter. F. L. U.

Lattice defects in silver halide crystals. F. SEITZ (Physical Rev., 1939, [ii], **56**, 1063—1064; cf. A., 1939, I, 128).—A discussion of the possibility of determining the nature and no. of lattice defects from the activation energy for the formation of lattice defects in ionic crystals. N. M. B.

Application of new photo-electric method to the determination of the optical constants of some pure metals. J. BOR, A. HOBSON, and C. WOOD (Proc. Physical Soc., 1939, **51**, 932—941).—A modification of the Drude method is described. The eye is replaced by a photo-electric cell and the extinction position is determined objectively by a Lindemann electrometer. Measured data for n and the extinction coeff. k over a λ range are tabulated for Cu, Ni, Cr, Pd, and Zn, and n, k, nk (absorption coeff.), $n^2 - k^2$, and R (reflexion coeff.) are plotted as functions of λ. N. M. B.

Optical properties of very thin metallic films. D. HACMAN (Z. Physik, 1939, **114**, 170—177; cf. A., 1939, I, 459).—Rigorous and approx. equations are set up for the evaluation of absorption and reflexion coeffs. from intensity measurements at non-perpendicular incidence. At perpendicular incidence these become similar to those of Murman and Wolter. L. G. G.

Optical properties of semi-transparent sputtered films determined by interference of light. J. B. NATHANSON and C. L. BARTBERGER (J. Opt. Soc. Amer., 1939, **29**, 417—426).—For Sn, Fe, Mn, Pt, Ni, and Cu films produced by sputtering in H_2, masses computed from interference data assuming optical consts. and densities are > those found by weighing. The discrepancy is in agreement with the view that the films consist of transparent insulating compounds, *e.g.*, oxides. L. J. J.

Temperature-dependence of the maximum emissive power of nickel. IV. F. CENNAMO (Nuovo Cim., 1939, **16**, 294—298; cf. A., 1939, I, 557, also below).—The dependence of max. emissive power of Ni on temp. is calc., and shown to be in agreement with experimental data. O. J. W.

Refractive index determinations in the infrared for parallel-sided specimens of glass. N. R. HANSEN (J. Proc. Roy. Soc. New South Wales, 1939, **73**, 67—73).—n is determined by measurement of the lateral displacement of a narrow parallel beam of radiation transmitted at oblique incidence. L. J. J.

Spectral emission of nickel at various temperatures. II. F. CENNAMO (Nuovo Cim., 1939, **16**, 253—260; cf. A., 1939, I, 557).—The emissive power of Ni in the range 1—7 μ. and at temp. > Curie point has been measured. Wien's law is verified for the range 590—1145° K., and from the variation of the product $\lambda_{max.} T$ with temp. the variation of the reflecting power of Ni with λ at 800 and 1000° K. is calc. O. J. W.

Effect of rotational and oscillational motion of molecules in crystals on their birefringence. S. S. RAO (J. Osmania Univ., 1936, **4**, 1—6).—Theoretical. W. R. A.

Alleged optical isomerism of 6-co-ordinated cupric salts. K. L. MANDAL (Current Sci., 1939, **8**, 469—470).—In $[Cu\,pn_2(H_2O)_2]I_2$ one mol. of H_2O is very loosely held, and the crystals rapidly lose lustre and form the monohydrate. It is concluded that a 6-co-ordinated Cu^{II} ion does not exist in the solid state, in agreement with the conclusion of Johnson and Bryant (A., 1935, 49). W. R. A.

Plasticity of rock-salt. M. STAMATIU (Bull. Acad. Sci. Roumaine, 1936, **17**, 209—216).—The characteristic curve of deformation of rock-salt differs from that of metals and other minerals obeying neither Hooke's law nor the exponential formula of Bach and Schüle. The elastic limit is reached at ~25 kg. per sq. cm. and the limit of small plastic deformations at ~100 kg. per sq. cm. Axial compression without the possibility of transversal deformation causes permanent deformation at 200 to 5000 kg. per sq. cm. due partly to porosity of the salt and partly to modification of the crystal lattice; above 5000 kg. per sq. cm. liquefaction occurs. Permanent deformations increase with temp. for const. pressure. F. H.

Glasses, organic and inorganic. H. MOORE (Chem. and Ind., 1939, 1027—1037).—The nature and structure of org. and inorg. glasses are discussed and their physical properties summarised and compared. J. W. S.

Electrical conduction of commercial boron crystals. J. H. BRUCE and A. HICKLING (Trans. Faraday Soc., 1939, **35**, 1436—1439).—The conduction by B crystals has been studied with both d.c. and a.c. After a preliminary burning-in process, during which the crystal behaves as a high resistance, a gas discharge current–voltage characteristic is produced, an increase in current above a certain val. being accompanied by a fall in the p.d. across the crystal. Results for a given specimen are closely reproducible even if the crystal is heated to redness by the current. The observations indicate that the gas discharge characteristic is not of thermal origin. J. W. S.

Benedicks homogeneous thermo-electric effect. H. L. C. CH'ENG and W. BAND (Proc. Camb. Phil. Soc., 1939, **35**, 622—636).—An unsymmetrical temp. distribution in a pure Ni wire in which the max. temp. is ≯160° gives rise to an e.m.f. (~1 μv.) dependent on the stationary temp. distribution and decaying slowly with time. The decay was irregular and when the temp. distribution was changing an abnormally large e.m.f. was found. The step-like decay effect

resembles, and is probably associated with, the positive emission from heated wires. L. J. J.

Crystal diamagnetism of tellurium. S. R. RAO and S. R. GOVINDARAJAN (Proc. Indian Acad. Sci., 1939, **10**, **A**, 235—252).—A detailed account of work already noted (A., 1939, I, 601). W. R. A.

Magnetothermal properties of some anomalous paramagnetic salts at low temperatures. G. A. MILJUTIN and S. S. SCHALIT (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 680—682).—For fields between 1000 and 11,000 gauss the magnetocaloric effects of $FeCl_2$ and $CoCl_2$ are linearly negative, and of $CrCl_3$ linearly positive. The temp.-dependence of this effect for $FeCl_2$ and $CoCl_2$ is positive at temp. > temp. of the sp. heat anomaly, at which point it changes sign. A further reversal is probable at temp. <14° K. For $CrCl_3$ the temp.-dependence is positive above and below the sp. heat anomaly at 16·8° K. The influence of the external magnetic field on the sp. heat jump is shown by shifts towards lower temp. for $FeCl_2$ and $CoCl_2$, but no effect is observed with $CrCl_3$. L. G. G.

Paramagnetism of the rare earths. B. CABRERA (J. Chim. phys., 1939, **36**, 237—255; cf. A., 1939, I, 409).—The Curie const. has been measured for $Gd^{\cdots}$, $Tb^{\cdots}$, $Dy^{\cdots}$, $Ho^{\cdots}$, and $Er^{\cdots}$ in the form of oxides and sulphates (anhyd. and with $8H_2O$). The vals. for all except $Tb^{\cdots}$ agree closely with theory. Magnetic moments are calc. F. L. U.

Specific coefficient of magnetisation of methæmoglobin. P. BERTHIER (Compt. rend., 1939, **209**, 774—776).—The sp. coeff. of magnetisation (*k*) of aq. methæmoglobin is measured by Curie and Chéneveau's balance. The effect on *k* of 0·02—0·1N-HCl and 0·02—1N-NaOH is determined as described previously (cf. A., 1939, III, 622). *k* increases on keeping the acid or alkaline solutions (but is unchanged in H_2O), which in a few days deposit solid material. The acid solutions are paramagnetic, and the alkaline diamagnetic, but solutions in 0·02—0·1N-NaOH become paramagnetic when kept. Between p_H 1·1 and 3·2, the vals. of *k* are irregular owing to flocculation of methæmoglobin. J. L. D.

Paramagnetic dispersion in iron ammonium alum. P. TEUNISSEN and C. J. GORTER (Physica, 1939, **6**, 1113—1122).—The paramagnetic dispersion of Fe NH_4 alum has been measured at liquid air temp. up to frequencies of 3800 kHz. and external magnetic fields up to 3200 oersted. Normal and " heavy " Fe NH_4 alum, both pure and diluted with Al^{+++}, give results in agreement with the theory of spin-temp. No cryst. anisotropy of dispersion is found. L. J. J.

Absorption of supersonic waves in acetone–water mixtures. P. A. BASHULIN and J. M. MERSON (Compt. rend. Acad. Sci. U.R.S.S, 1939, **24**, 690—691).—By means of a light-diffraction method the absorption coeffs. (α) for supersonic waves of ν between 19 and 38 megacycles have been measured for $COMe_2$–H_2O mixtures. When α/ν^2 is plotted against vol.-% $COMe_2$ (abscissa) a strong peak occurs at 70% which is six times the ordinate at either 0 or 100% $COMe_2$. L. G. G.

Optical properties of anisotropic liquid layers in the rotating magnetic field. V. ZVETKOV (Acta Physicochim. U.R.S.S., 1939, **11**, 537—548; cf. A., 1940, I, 15).—The behaviour of thin layers of anisotropic liquids in a rotating magnetic field has been examined by means of polarised light. In this way α, the phase-difference between the polarisation vector of the substance and the field, has been measured, and it is found in agreement with theory that sin $2\alpha \propto$ the frequency of rotation. F. J. G.

Freezing point of rhodium. C. R. BARBER and F. H. SCHOFIELD (Proc. Roy. Soc., 1939, **A**, **173**, 117—125).—A determination by means of optical pyrometer observations yields a val. on the international temp. scale of 1966±3°. G. D. P.

Thermal investigation of inorganic salts. A. T. JENSEN and C. A. BEEVERS (Trans. Faraday Soc., 1938, **34**, 1478—1482).—Differential cooling curves of 10 salts expected to exhibit thermal anomalies were examined down to −180°. $Ni(NO_3)_2,6NH_3$ shows a λ point at −28·6°; negative results were obtained with the others. F. L. U.

Certain properties of long-chain compounds as functions of chain length. M. L. HUGGINS (J. Physical Chem., 1939, **43**, 1083—1098).—The dependence on chain length of the heat content, heat capacity, entropy, and free energy of long-chain compounds in the solid, liquid, and gaseous states is discussed theoretically. Expressions for the dependence on chain length of m.p., heat and entropy of fusion at the m.p., and heat of vaporisation at the b.p. have been derived and tested with available data for normal paraffins. C. R. H.

Fluctuations, thermodynamic equilibrium, and entropy. E. C. KEMBLE (Physical Rev., 1939, [ii], **56**, 1013—1023).—Mathematical. Considerations necessary for eliminating exceptions to the second law due to fluctuation phenomena are developed. The second law of thermodynamics is derived from quantum statistics on the basis of the microscopic definition of entropy. N. M. B.

Exact formulæ for the true and mean specific heats of platinum between 0° and 1600°. F. M. JAEGER and E. ROSENBOHM (Physica, 1939, **6**, 1123—1125).—The heat content ($Q_{\theta°-0°}$) of Pt between 0° and 500° is $0·031357\theta + 0·04507 \times 10^{-4}\theta^2 - 0·0161 \times 10^{-7}\theta^3$ and between 400° and 1600° is $0·031622\theta + 0·03172 \times 10^{-4}\theta^2$. These vals. are based on a new val. for the m.p. of Pd, 1554·5°. L. J. J.

Heat capacity of cyanogen gas. (A) E. J. BURCIK and D. M. YOST. (B) F. STITT (J. Chem. Physics, 1939, **7**, 1114—1115, 1115).—(A) C_p for 273°, 296°, and 327° K. has been measured by the adiabatic expansion method and the vals. are in good agreement with those calc. from spectroscopic data.

(B) Vals. of C_v^0 for 185°, 294°, and 320° K. have been obtained by the hot wire method. The accommodation coeff. of C_2N_2 is intermediate between those of C_2H_4 and C_2H_2. The vals. of C_v^0 do not agree with those of Eucken and Bertram (A., 1936, 557) but accord with those of Burcik and Yost (see above). W. R. A.

Determination of specific heat of liquid dichlorodifluoromethane. L. RIEDEL (Z. ges. Kälte-Ind., 1939, **46**, 105—106).—The sp. heat (C) measured in a vac. calorimeter (described) from $-78{\cdot}7°$ to $20{\cdot}4°$ gives results summarised by $C = 0{\cdot}2232 + 3{\cdot}5 \times 10^{-4}\theta + 0{\cdot}013 \times 10^{-4}\theta^2$ g.-cal./g./degree. At very low temp. the experimental vals. agreed with those calc. thermodynamically.
R. B. C.

Volumetric behaviour of *iso*butane. W. M. MORRIS, B. H. SAGE, and W. N. LACEY (Amer. Inst. Min. Met. Eng., Tech. Publ. 1128, 1939, 7 pp.; Petrol. Tech., **2**, No. 4; cf. A., 1940, I, 84).—The sp. vol. of *iso*-C_4H_{10} has been determined at 7 temp. from 100° to 460° F., over a pressure range of 100—5000 lb. per sq. in. The data confirm previous liquid vals. (cf. A., 1938, I, 444). A. R. PE.

Calculation of the molecular radius of organic liquids from velocity of sound and density. W. SCHAAFFS (Z. Physik, 1939, **114**, 110—115).—M/ρ is substituted for v in van der Waals' equation and an expression for p derived in the new terms. By differentiating with respect to ρ and putting $dp/d\rho = u^2$, where u = velocity of sound in the liquid, the following equation is derived for the mol. radius: $r^3 = (3/16\pi N)(M/\rho)\{1 - (RT/Mu^2)[\sqrt{(1 + Mu^2/RT)} - 1]\}$. r, so calc. for 27 org. liquids, H_2O, D_2O, and Hg, is compared with vals. from mol. refraction data and from crit. consts. L. G. G.

Isotherms of helium at liquid helium temperatures. W. H. KEESOM and W. K. WALSTRA (Physica, 1939, **6**, 1146).—Data are recorded for $2{\cdot}050$—$4{\cdot}240°$ K. and up to densities near those of the saturated vapour. L. J. J.

Accidental deviations in the conduction of heat. L. S. ORNSTEIN and J. M. W. MILATZ (Physica, 1939, **6**, 1139—1145).—Theoretical. L. J. J.

Compressibilities and expansion coefficients of gases at low pressures, and their relation to molecular volume. J. B. M. COPPOCK (Proc. Roy. Soc., 1939, **A**, **173**, 201—211).—For non-polar gases at low pressures a linear relation exists between compressibilities and expansion coeffs. and the corresponding mol. vols. G. D. P.

Absolute system of viscosity and viscosity index. G. HUGEL and L. CLAIRBOIS (Ann. Off. nat. Combust. liq., 1939, **14**, 235—252).—An attempt is made to evolve a system permitting the representation and classification of as many η–temp. curves as possible. Expressions are derived for abs. η and η index; *e.g.*, the η index is given by $\eta = Ae^{2\cdot303c/(T-b)}$, where A, b, and c are consts. determined from experimental data. R. B. C.

Comparison of logarithmic formulæ linearly relating viscosities and temperatures. G. JUGE-BOIRARD (Ann. Off. nat. Combust. liq., 1939, **14**, 253—265).—The formula $\log \eta = \log k + a \log (\theta + c)$, where k, a, and c are consts., is shown to be superior to the Walther–Amer. Soc. Test. Mat. formula for expressing the data from 0° to 110° for H_2O, EtOH, and various oils. R. B. C.

Viscosity of air. J. A. BEARDEN (Physical Rev., 1939, [ii], **56**, 1023—1040).—Precision determinations were made by the rotating-cylinder method, and, for higher accuracy, rotating the inner instead of the outer cylinder. The treatment of W torsion wires eliminated the defects of zero drift and variability of torsion const. for static and dynamic conditions. η for air at 20° is $1819{\cdot}20 \pm 0{\cdot}06 \times 10^{-7}$ c.g.s. unit.
N. M. B.

Viscosity of gases and molecular mean free path. A. E. SCHUIL (Phil. Mag., 1939, [vii], **28**, 679—684).—Mol. mean free paths and mol. diameters, based on recent determinations of η, for a large no. of gases and vapours are tabulated. F. J. G.

Coefficient of thermal diffusion of methane. A. O. NIER (Physical Rev., 1939, [ii], **56**, 1009—1013).—On the theories of Enskog and Chapman, there should be a concn. gradient in a mixture of two gases if a temp. gradient exists. This effect is confirmed for $^{12}CH_4$ and $^{13}CH_4$ and the coeff. of thermal separation k_T ($= D_{T/D}$, where D_T = the coeff. of thermal diffusion and D = the coeff. of self-diffusion) is determined (cf. Furry, A., 1939, I, 395).
N. M. B.

Phase equilibria in hydrocarbon systems. Methane–ethane system in the gaseous region. B. H. SAGE and W. N. LACEY (Ind. Eng. Chem., 1939, **31**, 1497—1509).—The sp. vols. of CH_4, C_2H_6, and of various CH_4–C_2H_6 mixtures have been determined at 70—250° F., and at pressures $\not>$4750 lb. per sq. in. The partial sp. vols. of the components are calc. and the fugacities and partial enthalpies are deduced for the temp. and pressure ranges investigated. J. W. S.

Absorption of iodine in its chief solvents. F. CENNAMO (Nuovo Cim., 1939, **16**, 355—359).—Absorption max. of I in C_6H_6, CS_2, CCl_4, $CHCl_3$, MeOH, and EtOH for the region 2100—8900 A. are recorded. Solutions in solvents with dipole moment (μ) = 0 give absorption spectra similar to that of I vapour. With polar solvents the absorption max. are shifted to shorter λ, the displacement increasing with μ. Solutions in these solvents also give an absorption band with $\lambda_{max.} = 3600$ A. O. J. W.

Molecular interactions in solutions. Their effects on rotation of dipoles in an alternating [electric] field. P. GIRARD and P. ABADIE (Compt. rend., 1939, **209**, 874—877).—Admixture with C_6H_6 causes the dispersion and absorption curves of Pr^{a}OH for short Hertzian waves (λ 3—500 cm.) to become flatter, whilst the dispersion is considerably increased at λ <15 cm. Admixture with n-C_6H_{14} displaces both curves towards higher $\lambda\lambda$, without marked flattening. In each case the solutions are compared with Pr^{a}OH of equal η. The effects are due to hindrance of dipole rotation by mol. interactions.
A. J. E. W.

Viscosity in the systems: ketones–organic acids. II, III. V. V. UDOVENKO (J. Gen. Chem. Russ., 1939, **9**, 1512—1514, 1564—1567; cf. A., 1939, I, 606).—II. The η curves of the systems COMeEt or COMePr–HCO_2H and –AcOH, at 25°, 35°, and 45°, do not suggest compound formation. —III. Shrinkage taking place when $COMe_2$ is mixed

with HCO_2H, AcOH, or $PrCO_2H$ is max. for equimol. mixtures, and increases in the order given. The same applies to the systems AcOH–COMePr, –COMeEt, and $-COMe_2$. This suggests chemical reaction between the components, although the η–composition curves furnish no evidence of it.

R. T.

Specific gravity–temperature relationships for alum solutions. H. N. Bogart and D. S. Davis (Paper Ind., 1939, **21**, 657—658).—A nomograph is given for $Al_2(SO_4)_3$ solutions. H. A. H.

Apparent molar volumes of strong electrolytes in aqueous solutions. M. K. Srinivasan and B. Prasad (Trans. Faraday Soc., 1939, **35**, 1462—1465).—The d of dil. aq. solutions of $NaNO_3$, NaCl, KNO_3, and KCl have been determined at 35° and the apparent mol. vols. (ϕ) of the solutes are deduced. The vals. of ϕ follow the law $\phi = \phi_0 + K\sqrt{c}$ (cf. A., 1930, 31); the vals. of K are generally of the same order, but they are not identical for all electrolytes. The val. of K for $CsNO_3$ at 25°, calc. from the results of Jones and Ray (A., 1937, I, 126), is negative, however. J. W. S.

Viscosity and density of aqueous solutions of barium chloride, magnesium chloride, cobalt chloride, and nickel chloride at 35°. A. S. Chacravarti and B. Prasad (Trans. Faraday Soc., 1939, **35**, 1466—1471).—The viscosities (η) and d of aq. solutions of $BaCl_2$, $MgCl_2$, $CoCl_2$, and $NiCl_2$ have been measured at 35° and the apparent mol. vols. (ϕ) of the solutes have been determined. For all solutions η obeys the Jones and Dole equation $\eta/\eta_0 = 1 + A\sqrt{c} + Bc$, and except for $NiCl_2$ the observed vals. of A accord with the calc. vals. For concns. $>0{\cdot}025$M. ϕ obeys the law $\phi = \phi_0 + K\sqrt{c}$, but the vals. of K are not identical for all the electrolytes. J. W. S.

Viscosity of aqueous solutions of formic, cyanoacetic, and oxalic acids. M. K. Srinivasan and B. Prasad (J. Indian Chem. Soc., 1939, **16**, 371—374).—η of aq. solutions of HCO_2H, $CN{\cdot}CH_2{\cdot}CO_2H$, and $H_2C_2O_4$ have been measured at 35°. The vals. of η are represented satisfactorily by the two equations derived previously (A., 1938, I, 512), but vals. of the const. A do not agree with the theoretical val. The Jones and Dole equation (A., 1929, 1385) also represents the results but the consts. have no theoretical significance for weak electrolytes. W. R. A.

Photoluminescence of electrolyte solutions. I. B. E. Gordon and A. A. Schischlovski (Mem. Phys. Kiev, 1939, **8**, 91—95).—Photoluminescence of solutions of Tl^{I}, Pb^{II} UO_2, and Cu^{II} in H_2O or aq. EtOH is observed after addition of certain salts, in those cases in which complex ions are formed.

R. T.

Non-aqueous solutions. C. A. Kraus (Science, 1939, **90**, 281—289).—A lecture summarising work published previously (cf. A., 1938, I, 401; 1939, I, 198). L. S. T.

Abnormal osmotic effect with chain molecules. II. Synthesis and cryoscopic behaviour of polydepsides.—See A., 1940, II, 45.

Streaming in diffusion fields. G. Young (Bull. Math. Biophysics, 1939, **1**, 177—184).—Two cases of solvent motion in a diffusion field are discussed mathematically. In one case the solvent driving force arises from gravity, in the other from the η of the solute. C. R. H.

Hygroscopicity of mixtures. N. Schoorl (Pharm. Weekblad, 1939, **76**, 1541—1543).—Relative v.p. of saturated solutions of the following individual salts and mixture at 25° are recorded: $KCl-KClO_3$; KBr–NaBr; KNO_3-NaNO_3; KBr–NaBr–NH_4Br; NH_4Cl–NaBr; KBr–$NaNO_3$, KCl–$NaNO_3$, NaCl–KNO_3 (14·5°); NaCl–, KBr–, NaOAc–, KOAc–sucrose; KBr–$CO(NH_2)_2$; $CO(NH_2)_2$–sucrose.

S. C.

New glass in the binary system magnesium fluoride–silica. C. S. Piaw (Compt. rend., 1939, **209**, 884—885).—Globules of a vitreous substance containing SiO_2 and a large proportion of MgF_2 are formed by fusing MgF_2 on a fused quartz support in a coal gas–O_2 flame. They commence to melt at ~1460°, and have a low coeff. of thermal expansion. The high d (2·73—2·83, predominantly 2·81) indicates considerable shrinkage on formation of the glass. The optical absorption limit (2700—2620 A.) falls with d. A. J. E. W.

Transitions in the troilite mixed crystal range. H. Haraldsen (Tids. Kjemi, 1939, **19**, 144—147).—χ for FeS increases very rapidly with temp. up to 138°, less rapidly (linearly) to 325°, and then decreases linearly. At the first transition temp. there is a sudden large contraction along the c axis and increase of coeff. of expansion (α) along the a axis. This corresponds with disappearance of the superstructure to give a simple NiAs lattice. At the second transition temp. α decreases (a axis) and becomes negative (c axis). $FeS_{1{\cdot}09}$ shows similar, but less pronounced, transitions (74°, 325°), but in addition χ has a sharp max. val. at 210°, without lattice changes. $FeS_{1{\cdot}10}$ is ferromagnetic between 190° and 270° (max. 220°) and $FeS_{1{\cdot}15}$ at room temp. The development of ferromagnetism with increasing S content in the mixed crystal range FeS—$FeS_{1{\cdot}15}$ is due not to disappearance of the superstructure, but to the increased ease of exchange effects leading to parallelisation of spin vectors. M. H. M. A.

Structure of alloys. M. A. Rollier (Chim. e l'Ind., 1939, **18**, 615—622).—A lecture. O. J. W.

Optical constants of copper–nickel alloys. J. Bor, A. Hobson, and C. Wood (Proc. Physical Soc., 1939, **51**, 942—951).—Data for n and extinction coeff. in the λ range 4000—10,000 A. for Cu–Ni alloys (100% Cu to 100% Ni) are recorded and discussed.

N. M. B.

Paramagnetic susceptibility of copper–nickel and zinc–nickel alloys. M. A. Wheeler (Physical Rev., 1939, [ii], **56**, 1137—1145).—Using a Weiss–Foëx magnetic balance at a field of 11,000 gauss, susceptibilities (χ) of Ni alloys containing 0—60% Cu or 0—30% Zn were measured above their Curie temp. as a function of temp. Plots of $1/\chi$–T show that the Curie–Weiss law holds only in a restricted temp. range, the curve becoming concave towards the T axis at high

temp., especially for alloys of low Ni content. χ at a given temp. decreases less rapidly than linearly with % Cu or Zn added. Results are discussed with reference to the Heisenberg and the Bloch models. N. M. B.

Magnetic studies of solid solutions. I. Precipitation of iron from copper. F. BITTER and A. R. KAUFMANN (Physical Rev., 1939, [ii], **56**, 1044—1051).—Preliminary results and methods of observation are reported for Cu alloys containing $\ngtr$0·7% Fe in the temp. range 20—1000° and fields $\ngtr$40,000 gauss. Results indicate that Fe atoms in solution in Cu retain a permanent magnetic moment of ~3·5 Bohr magnetons, and obey a Curie–Weiss law at high temp., the Curie temp. of 0·7% Fe alloy being 150° K. The solution seems sluggish and can be greatly supercooled. A tentative interpretation of the apparently complex manner of pptn. from solution is given. N. M. B.

Diffusion of hydrogen through copper–nickel alloy. S. D. GERTZRIKEN and Z. P. GOLUBENKO (Mem. Phys. Kiev, 1939, **8**, 67—71).—A solid solution of Ni in Cu, obtained by heating a compressed 1 : 3 Ni–Cu mixture at 700° in a vac., has a lattice const. a 3·580 A., which falls to 3·577 A. after exposure to H_2. The diffusion coeff. of H_2 is $D = Ae^{-Q/RT}$, where A is a const., and Q = 35 kg.-cal. per g.-mol. of H_2, and represents heat of diffusion. R. T.

Microscopic analysis of intermediate phases in age-hardening alloys. M. L. V. GAYLER (Proc. Roy. Soc., 1939, **A**, **173**, 83—91).—The alloys examined are (i) Al–4% Cu, (ii) Al–4% Cu–0·5% Mg, and (iii) a commercial duralumin. The changes in the appearance of the pptd. phases during age-hardening are observed under magnifications of 2000 diameters. It is concluded that in the more complex alloys the final stage is reached by the formation of one or more intermediate phases, depending on the ageing temp. and constitution of the alloy. G. D. P.

Study of diffusion in lead–mercury and aluminium–zinc alloys by the method of vacuum vaporisation. S. D. GERTZRIKEN, M. G. BUTZIK, and Z. P. GOLUBENKO (Mem. Phys. Kiev, 1939, **8**, 55—65).—The val. of the coeff. of diffusion D of Hg through Pb rises with increasing [Hg] of the alloy, and with rising temp. (150—225°). The heat of diffusion Q is 12·3 and 10·1 kg.-cal. per g.-mol. for 5 and 10—15% Hg alloys, respectively. For 13·4 : 86·6 Zn–Al alloys the relation between log D and $1/T$ is linear (738—811° K.), and Q = 46 kg.-cal. per g.-mol.; D is independent of grain size. R. T.

Yttrium–aluminium alloys.—See B., 1940, 47.

Crystal chemistry of titanium alloys. F. LAVES and H. J. WALLBAUM (Naturwiss., 1939, **27**, 674—675).—Alloys of the formula AB_2 (12 g 6-types) can be expected if the ratio of at. radii is $\sqrt{3}/\sqrt{2}$ = 1·23. This condition obtains with some Ti alloys. The following compounds have been obtained: $TiMn_2$, $TiFe_2$, $TiCo_2$, $TiNi_3$, $TiCu_3$, $TiZn_3$, and $TiGa_3$ (?). The first three are 12 g 6-types. $TiCu_3$ has a deformed hexagonal spherical packing, and $TiZn_3$ is of the $ZnCu_3$ type with a 3·023±0·005 A. The X-ray diagram of $TiGa_3$ is very similar to that of $TiZn_3$. The compounds FeTi, CoTi, NiTi, and ZnTi have also been found. CuTi does not exist, although a compound of unknown cryst. type with a composition in this region has been obtained. Compounds XTi_2 (X = Mn, Fe, Co, Ni, Cu) are isomorphous, face-centred cubic crystals with 96 atoms in the unit cell. RuTi and OsTi have been obtained, corresponding with FeTi (CsCl type). Pd_3Ti (isomorphous with Ni_3Ti) and Pt_3Ti (same structure as Zn_3Ti) are also formed. PdTi and PtTi do not exist, although Pd_3Ti_2, Pt_3Ti_2, $PdTi_2$, and $PtTi_2$ have been obtained. Ag and Au do not form alloys with Ti of the same type as Cu–Ti alloys. No compounds of Ag and Ti have been obtained. A. J. M.

Defect lattices in ternary alloys. H. LIPSON and A. TAYLOR (Proc. Roy. Soc., 1939, **A**, **173**, 232—237).—In the Ni–Al system the dissolution of Al in the body-centred NiAl structure is accompanied by an omission of Ni atoms from some lattice points. In the ternary system Cu–Ni–Al the omission begins at a line of const. ratio of valency electrons to atoms. The Fe–Cu–Al and Fe–Ni–Al systems exhibit a similar property. The result is explained by the accommodation of electrons in the Brillouin zone. G. D. P.

Solubility of gases. II. Comparison of organic solvents with water. D. D. ELEY (Trans. Faraday Soc., 1939, **35**, 1421—1432; cf. A., 1939, I, 607).—The entropies and heats of dissolution of gases in liquids are discussed theoretically. The fact that the energy of dissolution of a gas in different org. solvents is approx. const., but is appreciably different in H_2O, is attributed to the different energies required for cavity formation in the solvents. For H_2O at room temp. structural modifications exist which complicate cavity formation. J. W. S.

Solubility of potassium dihydrogen phosphate in water. A. A. KAZANTZEV (J. Gen. Chem. Russ., 1938, **8**, 1230—1231).—The solubility (g. per 100 g. of solution) of KH_2PO_4 is given by $12·79 + 0·250\theta + 0·001820\theta^2 - 0·000006160\theta^3$, when θ is −2·75° to 90°. R. T.

Solubility of basic cupric salts in ammonia.—See B., 1940, 36.

Distribution equilibrium of sodium between molten sodium halides (NaBr, NaI) and a molten metal phase (Cd, Pb, Tl, Sn, Bi, Sb, Au). E. HEYMANN and H. P. WEBER (Trans. Faraday Soc., 1938, **34**, 1492—1501; cf. A., 1930, 992; 1935, 1063).—The distribution of Na between Cd and liquid NaBr is linear up to 20 at.-% of Na in the Cd, whence it is inferred that Na is in the at. state in the salt. With NaI the distribution is linear at 770°, but at 690° deviations occur at higher concns. With Pb as the metallic solvent non-linear curves are obtained, indicating the existence of strong interat. forces between Na and Pb. Sn, Bi, Sb, and Au pass into the salt with the Na when they are used as solvents, although in the absence of Na they are insol. Pb, Cd, and Tl do not behave in this way, and it is probable that their intermetallic compounds with Na are unstable at 770°, whereas those of the former group are stable and sol. in the molten salt. F. L. U.

Absorption of gas in the form of bubbles. Y. OYAMA and K. IWASE (Sci. Papers Inst. Phys.

Chem Res. Tokyo, 1939, **36**, 371—374; cf. A., 1939, I, 252).—Previous measurements on the absorption of CO_2 from a 36% mixture with air in dil. NaOH have been extended to bubbles up to 6·65 c.c. The measurements confirm that when dealing with large and non-spherical bubbles more effective absorption is not produced by increasing the subdivision of the gas mixture. D. F. R.

Adsorption error in the determination of gaseous densities and the adsorption of gases on vitreous silica. G. A. R. Hartley, T. H. Henry, and R. Whytlaw-Gray (Trans. Faraday Soc., 1939, **35**, 1452—1461).—The adsorption of C_2H_4, CO_2, N_2O, O_2, A, H_2, CO, and SO_2 on fused SiO_2 surfaces has been investigated. The results indicate that the adsorption even of easily liquefiable gases on clean SiO_2 is $\ll$ on glass surfaces, and that the use of SiO_2 vessels reduces to negligible proportions the uncertainties due to adsorption effects in the determination of compressibilities, expansion coeffs., and densities of gases. The results also confirm the reliability of the limiting density method for comparing the mol. wts. of gases by means of the SiO_2 buoyancy micro-balance. Adsorption of H_2 on SiO_2 is anomalously high, whilst the diffusion of He through SiO_2 is quite appreciable at 0°. J. W. S.

Sorption of ammonia on sodium chloride crystals. F. C. Tompkins (Trans. Faraday Soc., 1938, **34**, 1469—1478).—Details of experiments the results of which are discussed elsewhere (A., 1940, I, 21) are recorded. F. L. U.

(A) **New method for studying adsorption of gases at very low pressures and properties of adsorbed films of oxygen on tungsten.** (B) **Kinetics of formation of oxygen films on tungsten.** J. L. Morrison and J. K. Roberts (Proc. Roy. Soc., 1939, **A**, **173**, 1—13, 13—27).—(A) The method depends on the fact that the accommodation coeff. of Ne on a W surface is very sensitive to the presence of adsorbed films of traces of gas mixed with the Ne. The changes of accommodation coeff. which take place with varying O_2 pressure show that the adsorbed O_2 film consists of a layer, stable at the lowest pressures, on which is superposed at higher pressures a film in which the population depends on the pressure. The isotherm of this upper film has been determined; the mean life of a particle on the surface is about 2 sec. The lower film is itself composite; part of it evaporates at 1100° K., the remainder not until above 1700° K. The less stable part of the lower film is attributed to mols. adsorbed in gaps in the more stable part.

(B) The theory of the formation of the film is discussed. The experimental results are consistent with the view that the adsorbed layer consists of a stable film, with a less stable mobile film above it. G. D. P.

Separation of mixtures of gases by adsorption. —See B., 1940, 36.

Sorption and desorption of organic chlorine solvents by active charcoal.—See B., 1940, 19.

Hysteresis loop in sorption. K. S. Rao (Current Sci., 1939, **8** 468—469).—The sorption and desorption of H_2O vapour at 30° has been followed on TiO_2 gel activated at 300° and degassed in a vac. for 5 hr., using the quartz fibre spring technique. Hysteresis is exhibited. On desorbing the system with any intermediate point on the loop of the sorption curve as starting point, the loop is crossed and the desorption curve is reached. On the other hand sorption, starting from any intermediate point on the desorption curve, follows an independent course until the peak of the hysteresis loop is reached. These observations can be explained only on the cavity concept (cf. McBain, A., 1935, 701). The porous TiO_2 gel is considered to contain V-shaped pores and narrow-necked cavities, the latter being solely responsible for the hysteresis. The cavities are only emptied by desorption when the pressure is < the min. at which the H_2O condensed in the necks will be in equilibrium with the vapour. At any point along the looped part of the sorption curve there are always some cavities filled with H_2O; on desorption, some of this is entrapped and the hysteresis loop is consequently crossed until the main desorption curve is reached. At points along the desorption curve some of the larger cavities still contain H_2O; the effect of sorption at these points is to trace curves secondary to the main sorption curve, all of which reach the peak of the hysteresis loop. Similar experiments on the SiO_2 gel–H_2O system further confirm the cavity theory. W. R. A.

Adsorption of acetic acid by mercury. R. C. L. Bosworth (Trans. Faraday Soc., 1939, **35**, 1349—1352).—The max. bubble pressure method has been used to measure the effect of various pressures of AcOH vapour on the surface tension (γ) of Hg at 20—260°. The AcOH decreases γ, particularly at lower temp., and reverses the sign of $d\gamma/dT$ at lower temp. and higher pressures. The amount of AcOH adsorbed decreases with rise of temp. The heat of adsorption varies from 8·3 to 6·1 kg.-cal. per g.-mol. as the surface concn. increases from 0·25 to 4×10^{14} mols. per sq. cm. J. W. S.

Adsorption of radioactive elements on polar crystals. II. Primary adsorption. A. P. Ratner (Acta Physicochim. U.R.S.S., 1939, **11**, 475—483; cf. A., 1936, 1457).—Theoretical. Ions primarily adsorbed are either those which can form solid solutions in the adsorbing crystal or those composing the crystal (potential-determining). Equations are proposed for both types of adsorption. An equation is also deduced for the concn. difference between the isoelectric and equivalence points. F. L. U.

Surface tension of mercury by the maximum bubble pressure method. R. C. L. Bosworth (Trans. Faraday Soc., 1938, **34**, 1501—1505).—Gas bubbles of two types are obtained at the ends of stainless steel tubes dipping in Hg, corresponding with bubbles breaking from the external and internal edges. With rising temp., the former are produced below 60°, the latter above 150°, and the "internal" type then persists on cooling to room temp. The surface tensions (γ) calc. from the observed pressures differ by 3% for the two types. With an amalgamated Cu tube having a knife-edge of negligible thickness

the calc. γ is that pertaining to bubbles of the "external" type, viz., 484 dynes per cm. at 20°, with a temp. coeff. of 0·21 dyne per cm. per 1°, using air; with CO_2 γ is 1% lower. F. L. U.

Effect of carbon dioxide on the surface tension of mercury. R. C. L. Bosworth (Trans. Faraday Soc., 1939, **35**, 1353—1354).—The γ of Hg has been measured in contact with air of varying CO_2 content. With increasing [CO_2], γ decreases initially to a min. ~8% < the val. in pure air at ~3% CO_2, but thereafter rises slowly with increasing [CO_2] until in pure CO_2 its val. is ~1·5% < in pure air. In view of the strong positive adsorption observed from all air–CO_2 mixtures it is inferred that the Gibbs layer on Hg is thick enough to contain O_2 or N_2 in excess of the amount of CO_2. J. W. S.

Surface tensions of two-phase liquid systems containing benzene. J. W. Belton (Trans. Faraday Soc., 1939, **35**, 1354—1361; cf. A., 1936, 150).—The γ of the liquid phases of the systems C_6H_6–CS_2–H_2O and C_6H_6–AcOH–H_2O have been measured at 25° by the max. bubble pressure method, and the Gibbs equation is applied to the results. For the system C_6H_6–CS_2–H_2O the adsorption of C_6H_6 at the liquid–vapour interface increases to a max. and then decreases, whilst that of CS_2 at the liquid–liquid interface decreases, with increasing [C_6H_6]. In the system C_6H_6–AcOH–H_2O, AcOH is adsorbed at each interface, the amounts adsorbed at the liquid–liquid and aq. layer–air interface passing through a max. when the [AcOH] in the aq. layer is 2M. whilst the amount adsorbed at the C_6H_6 layer–air interface increases with increasing [AcOH] throughout the concn. range investigated. The adsorption of AcOH at the aq. phase–air interface is calc. by an indirect method, and is shown to be almost equal to that at the liquid–liquid interface. J. W. S.

Application of surface tension measurements to determination of double salts in solution. G. Arcay and M. Marcot (Compt. rend., 1939, **209**, 881—882).—The formation of $KCl,2HgCl_2$, $KCl,HgCl_2$, $2KCl,HgCl_2$, and the corresponding Na salts in aq. solutions of KCl (or NaCl) and $HgCl_2$ is detected by min. in the γ–composition curves. A. J. E. W.

Interfacial tension, p_H, and chemical constitution. R. A. Peters and R. W. Wakelin (Trans. Faraday Soc., 1938, **34**, 1537—1539).—The interfacial tension (γ) of C_6H_6 solutions of an amine and aq. buffers of varying p_H falls in a similar manner for $C_{16}H_{33}{\cdot}NH_2$ and $C_{18}H_{37}{\cdot}NH_2$ when the p_H changes from 10 to 7. It is inferred that long-chain amines show interfacial changes in ionisation at a lower p_H than when ionising in a bulk phase. A comparison of the γ–p_H curves for C_6H_6 solutions of α-hydroxy-palmitic and -stearic acids against aq. buffers with that of stearic acid shows that the OH group displaces the apparent p_K at an interface towards lower p_H as compared with the unsubstituted acid. F. L. U.

Behaviour of *n*-decoic acid in interfacial tension measurements. R. W. Wakelin (Trans. Faraday Soc., 1938, **34**, 1535—1536).—The abnormal change of interfacial tension with p_H observed by Peters (A., 1931, 1228) for C_6H_6 solutions of *n*-decoic acid (I) against phosphate and glycine buffers is shown to be due to the increasing solubility of (I). F. L. U.

Change in drop of potential at the air–solution interface as related to the age of the latter. A. I. Pankratov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 149—151).—The causes of the variation with time of the potential drop at an air–solution interface, observed by Klein and Lange (A., 1938, I, 520), have been investigated. The data indicate that if the surface of aq. solutions (2N-KBr, 0·01N-KCl) is kept free from surface-active material no variation in the potential drop occurs over large intervals of time. If, however, the solution surface becomes contaminated the potential drop changes gradually to more positive vals. The potential drop of 0·01N-KCl changes < that of 2N-KBr as expected, since the presence of KBr in the solution facilitates the spreading of monolayers over the surface. The surface-active materials present in the two salts may be removed by previous heating. W. R. A.

Viscosity of unimolecular surface films. M. Joly (Kolloid-Z., 1939, **89**, 26—35).—A general survey (cf. A., 1938, I, 77, 355, 396, 615; 1939, I, 317, 367). F. L. U.

Surface reaction between oxonium ions and mica. R. S. Bradley (Trans. Faraday Soc., 1939, **35**, 1361—1366).—When aq. NH_4I is evaporated on clean mica surfaces it crystallises in regularly arranged tetrahedral crystals, but if the mica has been pre-treated by immersion in N-H_2SO_4 it crystallises irregularly in cubes. 10N-KOH and saturated aq. KCl, $CaCl_2$, and $BaCl_2$ have no effect on the orienting power of the mica. Quant. studies, carried out by immersing the mica for various times in buffer solutions of various p_H vals., and observing the proportion of the oriented tetrahedra and unoriented cubes formed, are interpreted on the assumption that the mica surface is attacked by oxonium ions. J. W. S.

Identification of aluminium oxide hydrate films of importance in silicosis prevention. L. H. Germer and K. H. Storks (Ind. Eng. Chem. [Anal.], 1939, **11**, 583—592).—Electron diffraction experiments on the films formed on SiO_2 in presence of H_2O and Al are recorded. SiO_2 films that have floated on H_2O containing Al powder at room temp. are identical with those obtained from untreated SiO_2, but after floating at 38° the film formed is a hydrated oxide of Al, which after drying in the vac. of the diffraction camera, is cryst. Al_2O_3,H_2O (boehmite) (I). The film is probably a highly hydrated gelatinous oxide which becomes cryst. only on drying. A film containing Al but no Si is also formed on soaking a rod of fused quartz in H_2O containing Al powder at 38°. SiO_2 films are often weakened or broken up by treatment with Al and H_2O at 38°, especially if any gas bubbles produced by the reaction between Al and H_2O reach the surface. Scum consisting of (I) forms on H_2O surfaces in Bakelite beakers containing Al and H_2O at 38°. L. S. T.

Changes of phase and transformations of higher orders in monolayers. D. G. Dervichian

(J. Chem. Physics, 1939, **7**, 1113).—An addendum (cf. A., 1940, I, 22). W. R. A.

Method of spreading monolayers of albumin and lipin–albumin mixtures. S. Ställberg and T. Teorell (Trans. Faraday Soc., 1939, **35**, 1413—1416).—60% aq. $Pr^{\alpha}OH$ or $Pr^{\beta}OH$, 0·5M. in NaOAc, can be used as solvent for spreading monolayers of albumins, lipins, or lipin–albumin mixtures on aq. solutions. J. W. S.

Surface films of heat-denatured serum-albumin. S. Ställberg (Trans. Faraday Soc., 1939, **35**, 1416—1420).—Heat-denaturation of serum-albumin causes ~15% increase in the area of its monolayers, accompanied by changes in their compressibility, rigidity, and gelation point, but there is no significant change in the apparent dipole moment. J. W. S.

Spreading of different hæmoglobins, muscle hæmoglobins, and cytochrome ***c*****.**—See A., 1940, III, 69.

Thin protein membranes. O. Gatty and J. H. Schulman (Trans. Faraday Soc., 1939, **35**, 1510—1513).—Stable multilayers of egg-albumin have been deposited on wire mesh gauzes and silk by deposition from monolayers. The films are impermeable to isamine-blue, but sufficiently permeable to NaCl for 200 monolayers to hold a diffusion potential different from that in the absence of membrane at a val. which decays with a half-life period of 20 min. The presence of 40 layers of lipoprotein from amphibian eggs does not affect the half-life period of the potential or its val. It is inferred that diffusion consts. for NaCl through protein multilayers are < through H_2O and that the partition coeff. leads to lower salt concns. in the membrane. J. W. S.

Capillary systems. XXII₄. Preparation and characterisation of electropositive membranes. E. Manegold and K. Kalauch (Kolloid-Z., 1939, **88**, 257—273).—Various kinds of membrane having selective anion permeability are described, the most serviceable of which are supported metal hydroxide membranes made by treating collodion solutions of Fe, Al, Cr, or Th chloride with $(CH_2)_2O$. When these are used in the cell 0·1N-KCl–membrane–0·01N-KCl a p.d. of ~50 mv. is developed, indicating nearly perfect semipermeability for anions. A new method of measuring the electro-osmotic transfer of H_2O across a membrane is described. F. L. U.

Brownian movement. E. Kappler (Naturwiss., 1939, **27**, 649—658, 666—670).—A review dealing with the theory of the Brownian movement with and without the application of an external force, the movement in a vac., and its importance in the technique of measurement. The observation of the Brownian movement with the unaided eye is also dealt with. A. J. M.

Electric double layer and stability of emulsions. E. J. W. Verwey (Chem. Weekblad, 1939, **36**, 800—803).—The electrical factors affecting the stability of emulsions, particularly in absence of emulsifiers, are discussed. S. C.

Sedimentometric study of coarse disperse systems. Influence of concentration of disperse phase on distribution of particles in aqueous suspensions of barium sulphate in presence of electrolytes. N. A. Figurovski and V. N. Rosanova (Acta Physicochim. U.R.S.S., 1939, **11**, 361—378).—The size-distribution of particles in coarse (1—7 μ.) aq. $BaSO_4$ suspensions has been determined with a modified sedimentation balance, which is described. Increasing the concn. of the disperse phase from 0·05 to 2% in electrolyte-free suspensions leads to a small decrease in the finer and an increase in the coarser fractions; the same effect is shown in a marked degree by suspensions which, whilst containing no detectable amount of electrolyte, have been less thoroughly washed. Distribution curves for suspensions containing varying amounts of NaOH, NaCl, and of H_2SO_4 have also been obtained, and the results are discussed. F. L. U.

Stabilisation of sulphur hydrosols by protective agents. B. G. Zaprometov and S. A. Vasilieva (Bull. Univ. Asie Centr., 1937, No. 22, 139—158).—Stable, highly disperse S hydrosols are obtained by adding the protective agent (tannin, dextrin, sucrose, or *p*-toluidine) to aq. SO_2 and passing H_2S 40 min. later, with energetic stirring. Dry colloidal S is re-dispersed by stirring with dil. aq. SO_2, cooling to 0° from time to time. R. T.

Property of radio-colloids. (Mlle.) C. Chamié and (Mme.) B. E. Marques (Compt. rend., 1939, **209**, 877—879; cf. A., 1939, I, 319).—The formation of groups of Po atoms on a paraffin wax surface immersed in an acid solution containing Po is due to deposition of colloidal aggregates from the solution, and not to residual activity from an adhering layer of liquid. As log [Po] increases the proportion of the Po so deposited from N-HNO_3, under standard conditions, rises to a sharp max. and then falls more slowly; the curve resembles that for separation by centrifuging from acids of different concn. A. J. E. W.

Preparation of rhenium in the colloidal state, and its catalytic properties. C. Zenghelis and (Mlle.) C. Stathis (Compt. rend., 1939, **209**, 797—799).—A stable, dark brown, negative colloidal solution of Re is obtained by reduction of aq. K_2ReCl_6 with N_2H_4 and CH_2O in presence of gum arabic. The dispersed Re absorbs 700 times its vol. of H_2; the solution catalyses the decomp. of alkaline H_2O_2, formation of NH_3 from N_2 and H_2, and the hydrogenation of maleic and cinnamic acids. A. J. E. W.

Equilibrium between molecular and colloidal substances in aqueous soap solutions. II. Temperature-dependence of the equilibrium and solubility curve of soaps. J. Stauff (Z. physikal. Chem., 1939, **185**, 45—59; cf. A., 1939, I, 24).—The equilibrium is studied by assuming that the concn. of mol. Na palmitate (I) in dil. solutions = c_k, the crit. concn. for micelle formation. c_k is determined from a_{OH}–c curves at 25—90°; the corresponding a_{OH}–T curves have a sharp break at T_m, at which the solubility (s) of (I) = c_k. The variation of c_k with T is very small, showing that

temp. has little effect on the equilibrium. The s curve of (I) ($s \not> 1$ g.-mol. per l.) is plotted from vals. of the temp. of separation and dissolution. s rises rapidly above T_m, as the additional $Na^{\cdot}$ necessary to maintain the equilibrium as T increases can be obtained only by micelle formation. The data are used to determine vals. of the activity coeff. of $Na^{\cdot}$ in the (I) solutions. Determinations with Na stearate, myristate, and laurate show that T_m falls as the no. of C in the acid mol. decreases, in accord with the theory. A. J. E. W.

Colloid optics. III. Scattering of light by stearic acid hydrosols and by sodium stearate sols and gels. K. SUBBARAMAIAH (Proc. Indian Acad. Sci., 1939, **10**, A, 289—295).—The sol–gel transformation of Na stearate (I) solutions in H_2O, and the changes occurring on heating a stearic acid hydrosol, have been studied by optical methods. Owing to the presence of rod-like micelles, acid hydrosols exhibit the schlieren effect, which disappears at a definite transition temp. on heating, indicating a change from the solid to the liquid state of the micelles. Light scattering studies show that acid hydrosols have a large micellar size which increases on heating, and a high asymmetry at low temp., and that (I) sols grow in size, and exhibit enhanced asymmetry on cooling. It is concluded that micelles join to form long chains, passing to fibrils, and finally to a curdy, opaque gel, the temp. of gelation being a function of the concn. of the sol. W. R. A.

Colloid chemistry of system soaps–cresol–water. IV. Viscosity of cresolated sodium stearate solutions in presence of free fatty acids. E. ANGELESCU and V. CIORTAN (Kolloid-Z., 1939, **89**, 47—54; cf. A., 1938, I, 246).—Data are recorded for Na stearate solutions, with and without *o*-, *m*-, and *p*-cresol, in presence of palmitic, stearic, and oleic acids. In the absence of cresol addition of fatty acid in amounts $\not> 10$ mol.-% of the soap causes little change in the η beyond what would result from addition of an equiv. amount of soap. In presence of cresol the η max. on the η–cresol concn. curve is much raised by stearic, slightly raised by palmitic, and slightly depressed by oleic acid. F. L. U.

Ageing phenomena and molecular dimensions of chain complexes in solution. [II.] W. WEHR (Kolloid-Z., 1939, 88, 290—318; cf. A., 1939, I, 521).—The mol. wt. of cellulose nitrate in 0·025—10%, and of polyvinyl acetate in 0·03—4%, solutions in BuOAc is calc. from η measurements by several formulæ, of which that of Bredée and de Booys (A., 1937, I, 303) is the most satisfactory. Experimental details relating to this and part I and a bibliography are given. F. L. U.

Macromolecular compounds. CCXXXIV. X-Ray study of polymeric-homologous cellulose fibres. E. PLÖTZE and H. PERSON (Naturwiss., 1939, **27**, 693).—The Debye–Scherrer diagrams of ramie over a range of degree of polymerisation of 3000—200 are identical; the same is true of cotton over the same range. This confirms the belief previously held, that the orientation of crystallites is independent of the degree of polymerisation within a given polymeric-homologous series. F. L. U.

Quantitative interpretation of force–extension diagrams of isotropic cellulose threads on the basis of a rational theory of the relation between degree of orientation and strength. P. H. HERMANS (Proc. K. Akad. Wetensch. Amsterdam, 1939, **42**, 798—807; cf. A., 1939, I, 522).—Preliminary. O. D. S.

***X*-Ray study of orientation of artificial fibre. I.** V. A. KARGIN and N. V. MICHAILOV (Acta Physicochim. U.R.S.S., 1939, **11**, 343—360).—The distribution of micelles with respect to their angles of inclination to the fibre axis has been determined by microphotometry of *X*-ray photographs of cellulose fibres (viscose and cuprammonium) subjected to various treatments. Neither artificial silks spun under tension nor those stretched after spinning show a Gaussian distribution, and it is inferred that the fibre does not attain equilibrium after stretching. The increased orientation produced by stretching is of a temporary and unstable character, and dis-orientation occurs spontaneously when the fibre is boiled in H_2O for a few min. The results as a whole are opposed to the Mark–Meyer theory of the micro-cryst. structure of cellulose, and indicate that it should be considered as a liquid containing more or less oriented swarms of micelles which do not constitute regularly formed crystals. F. L. U.

Degradation of cellulose by polarised ultra-violet light.—See B., 1940, 27.

Priority questions in the kinetic theory and thermodynamics of rubber-like elasticity. E. WÖHLISCH (Helv. Chim. Acta, 1939, **22**, 1358—1362).—Priority is claimed over Meyer and others. J. W. S.

History of the theory of rubber elasticity. K. H. MEYER (Helv. Chim. Acta, 1939, **22**, 1362—1364; cf. A., 1940, I, 18 and preceding abstract).—A reply to Wöhlisch. J. W. S.

Colloid-chemical properties of thermolysed gelatin, and the potentiometric titration of the products of its acid hydrolysis. M. A. CHENOCH (J. Gen. Chem. Russ., 1939, **9**, 1479—1488).—The η of 1% aq. gelatin is almost unchanged by heating at 120° for 20 hr.; that of 10% gelatin falls rapidly during the first 4 hr., thereafter remaining nearly const. The effect is chiefly one of fission of peptide linkings, with production of smaller, more highly hydrated mols. At the same time the protective action of the solutions with respect to $Fe(OH)_3$ sol rises. The NaOH-binding power of acid hydrolysates (2% HCl or H_2SO_4 at 150° and 180°) rises with increasing duration of hydrolysis to a limiting val. Autoclaving at 150—180° leads to disappearance of the biuret reaction within 1 hr. R. T.

Reactions between electrolytes and proteins. V. Reactions with calcium and magnesium: results. E. J. BIGWOOD (Bull. Soc. Chim. biol., 1939, **21**, 1105—1116; cf. A., 1940, I, 81).—When sols of serum-albumin, ψ-globulin, or gelatin, or gelatin gel, containing $CaCl_2$, $MgCl_2$, and $MgSO_4$ are in equilibrium with the respective salt solutions

across a membrane impermeable to the colloid, the distribution of $Ca^{\cdot\cdot}$, $Mg^{\cdot\cdot}$, Cl', and SO_4'' is approx. in accordance with the Donnan theory in the range p_H 2·9—6·9, but not at the isoelectric point and at higher p_H, since the anion and cation contents of the protein solution are then greater than those of the ultrafiltrate. On the assumption that only simple Ca and Mg salts of the proteins are formed, the Donnan equations do not explain the results even if the salts are only partly dissociated. W. McC.

Formation of periodic precipitates in the interior of other precipitates. B. N. Sen (R.C. Atti Accad. Lincei, 1939, [vi], **29**, 488—490).—The nature of the rings found when $Cu_2[Fe(CN)_6]$ is pptd. in presence of $CaSO_4$ and of $BaSO_4$ has been studied in relation to the concn. of the pptg. reagents. O. J. W.

Effect of ultra-violet rays on Liesegang rings. C. Maxia (Boll. Soc. ital. Biol. sperim., 1939, **14**, 444—445).—Bibliographical evidence that ultra-violet irradiation modifies Liesegang rings is given. F. O. H.

Runge patterns and Liesegang rings on filter-paper. E. Deiss (Kolloid-Z., 1939, **89**, 146—161). Characteristic patterns (described by Runge in 1855) may be obtained when a liquid B is allowed to drop slowly on filter-paper soaked in a solution A. Suitable A–B pairs are $Fe_3(SO_4)_2$–$K_4Fe(CN)_6$, $CuSO_4$–$K_4Fe(CN)_6$, $MnSO_4$–K_2CrO_4, etc., which give rise to "pptn. patterns." If non-reacting solutions are used, or if the liquid B is H_2O, "displacement patterns" are obtained, which may be made visible by suitable after-treatment. In one case only, viz., A–B = K_2CrO_4–$MnSO_4$ + K_2SO_4, has the formation of Liesegang rings been observed; they are not formed, however, if the solutions are interchanged, or if the K is partly or entirely replaced by Na, or if the R.H. is $\gg$50%. The various reactions are described and figured, and the reaction between $Mn^{\cdot\cdot}$ and CrO_4'' is discussed. F. L. U.

Theory of electrophoretic migration. H. Mueller (Ann. New York Acad. Sci., 1939, **39**, 111—120).—A review. F. L. U.

Determination of electrical charge of surfaces by the microscopic method of electrophoresis. H. A. Abramson (Ann. New York Acad. Sci., 1939, **39**, 121—145).—A descriptive review of experimental methods. F. L. U.

Moving boundary method for studying electrophoresis. K. G. Stern (Ann. New York Acad. Sci., 1939, **39**, 147—186).—Historical and descriptive. Special attention is given to recent developments in the study of colourless solutions. F. L. U.

Observations of electrophoretic boundaries. L. G. Longsworth (Ann. New York Acad. Sci., 1939, **39**, 187—202).—The "schlieren" and "scale" methods for ascertaining the position of colourless boundaries have been compared. The latter is the more economical and the more flexible of the two, whilst the former lends itself to automatic recording and also permits the progress of the boundary to be followed visually. F. L. U.

Effect of salts on electrophoretic mobility of tristearin at constant p_H. D. I. Breese and W. C. M. Lewis (Trans. Faraday Soc., 1938, **34**, 1515—1518; cf. A., 1938, I, 456).—The mobility (u) of tristearin (I) particles at p_H 4 increases slightly with rising concn. of KCl and of LiCl at very low concns., and thereafter falls steadily to a limiting val. which shows a small lyotropic influence. With KI and KCNS the u-concn. curve falls to a flat min. and then ascends continuously up to concns. >0·1N.; this effect, which is distinct from the normal small increase in u at very low concns., is greater with KCNS than with KI, and still more marked with the Li salts. It is attributed to primary adsorption of I′ and CNS′ on (I), and this explanation is supported by the observation that the γ of a C_6H_{14}–H_2O or decalin–H_2O interface is lowered by KI, LiI, KCNS, and LiCNS, although raised by KCl. F. L. U.

Characteristics of protein boundaries as shown by scale method electrophoretic diagrams. F. L. Horsfall (Ann. New York Acad. Sci., 1939, **39**, 203—207).—Scale method diagrams permit the identification and calculation of mobilities of minor components in protein mixtures. Unambiguous diagrams are obtained only when the protein has been dialysed thoroughly against a buffer solution of sufficient ionic strength. There is normally a slight asymmetry between the ascending and descending boundaries, the former being sharper and slightly less broad. Examples of scale diagrams obtained with hæmocyanin solutions are given. F. L. U.

Electrolysis and electro-osmosis in gelatin. J. Swyngedauw (Kolloid-Z., 1939, **88**, 318—328).—A summary of published work (cf. A., 1936, 1396; 1937, I, 616; 1938, I, 398; III, 324, 756; 1939, I, 29, 198, 260, 321, 370). F. L. U.

Streaming potential and surface conductivity. III. E. Verlende (Proc. K. Akad. Wetensch. Amsterdam, 1939, **42**, 764—775; cf. A., 1938, I, 573).—Apparatus for the measurement of streaming potential is described. Vals. of the electrokinetic potential and of the surface conductivity of dil. aq. solutions of KCl, HCl, and $CaCl_2$ are calc. from measurements of the streaming potential. O. D. S.

Equilibrium between valine and ammonium dimethylpyruvate. R. Wurmser and S. Filitti-Wurmser (Enzymologia, 1939, **7**, 161—164; cf. A., 1938, I, 402).—Electrometric measurements made with mixtures of d-NH_2-acid oxidase, dl-valine, $Pr^{\beta}CO{\cdot}CO_2NH_4$, buffer, and indicator, of the oxidase, dl-valine, NH_4Cl, KCl, buffer, and indicator, and of the oxidase, dimethylpyruvic acid, buffer, and leucophenosafranine show that, at p_H 7 and 37° when the ratio of the activities of the constituents is 1, E_0 of the system valine $\rightleftharpoons$ $Pr^{\beta}CO{\cdot}CO_2'$ ion + $NH_4^{\cdot}$ is $-0{\cdot}115\pm0{\cdot}015$ v. This val. holds on the assumption that the equilibrium mixture does not contain an appreciable amount of imino-acid. W. McC.

Cryoscopic study of copper and silver halides in benzene and ethylene dibromide solutions of aluminium bromide. E. J. Gorenbein and I. M. Slavutskaja (J. Gen. Chem. Russ., 1938, **8**, 1169—

1178).—The mol. depression of f.p. of C_6H_6 and $C_2H_4Br_2$ solutions of $AlBr_3$ following addition of MX (M = Ag, Cu^I) falls with increasing concn. of the latter, whilst at the same time mol. conductivity rises. These results confirm formation of the compounds $MX,AlBr_3$ (X = Cl, Br, I) and $MX,2AlBr_3$ (X = Cl, Br), which become increasingly associated with rising concn.; the conductivity of the systems is $\propto$ concn. of associated complex. Association of the complexes in C_6H_6 is > in $C_2H_4Br_2$, and of Ag > Cu^I complexes. R. T.

Definition of "acid" and "base." A. I. SCHATTENSTEIN (J. Gen. Chem. Russ., 1939, **9**, 1603—1610).—Theoretical. R. T.

Thermodynamics of acid–base equilibria. D. H. EVERETT and W. F. K. WYNNE-JONES (Trans. Faraday Soc., 1939, **35**, 1380—1401).—Experimental data for the electrolytic dissociation of a large no. of weak acids have been analysed and vals. of $\Delta G°$, ΔH, $\Delta S°$, and ΔC_p for the various equilibria are deduced. Except for positively charged acids (*e.g.*, substituted $NH_4^{\cdot}$ ions) the vals. of $\Delta S°$ and ΔC_p are negative at room temp. The sign and magnitude of ΔH are explained by the orientation of solvent mols. around the ions. The relationship between the mol. structure and thermodynamic properties of the acids is discussed, and it is pointed out that for proper comparison of the strengths of acids it is necessary to take into account the vals. of the other thermodynamic functions as well as the dissociation const. J. W. S.

Magneto-optic study of neutralisation. F. GALLAIS and D. VOIGT (Compt. rend., 1939, **209**, 872—874).—The magnetic rotation (Faraday effect) of solutions containing acid and alkali has a sharp min. at the neutral point, at which the displacement from the additive val. increases with the concn. and the strength of the acid. Sharp min. do not occur at the intermediate stages of neutralisation of a polybasic acid. Abnormally large effects with HNO_3 and HCNS are attributed to the formation of the complex and *iso*-forms, respectively.
A. J. E. W.

Ionic equilibria in hydrogen salts of dibasic acids. C. W. DAVIES (J.C.S., 1939, 1850—1853). With H salts of weak dibasic acids H_2A, the process $2HA' \rightleftharpoons H_2A + A''$ is usually much more important than is $HA' \rightleftharpoons H^{\cdot} + A''$. Equations giving the relative concns. of HA', A'', and H_2A are derived, and vals. are tabulated for 6 common acids. The equations enable the mobility of HA' to be calc. from conductivity data. Other consequences of the equilibria are discussed. F. L. U.

Dissociation constant of the anilinium ion. K. J. PEDERSEN (Kong. dansk. Vidensk. Selsk., mat.-fys. Medd., 1937, **14**, 26 pp.; Chem. Zentr., 1937, i, 3473—3474).—K is determined by e.m.f. measurements on the cell $H_2|NH_2Ph,NH_3PhCl,NaCl|$ $3{\cdot}5$M-$KCl|HCl,NaCl|H_2$, using glass electrodes; the $H^{\cdot}$ activity coeffs. for the solutions are eliminated by a method of extrapolation which refers their vals. to *s*M-NaCl, in which $-\log K = 4{\cdot}428 + 0{\cdot}20s$, $4{\cdot}596 + 0{\cdot}22s$, and $4{\cdot}780 + 0{\cdot}26s$ at 34·9°, 25·0°, and 14·8°, respectively. The heats of dissociation and neutralisation are 7105 and 6587 g.-cal. per g.-mol.
A. J. E. W.

Dissociation constant of β-resorcylic acid. C. T. ABICHANDANI and S. K. K. JATKAR (J. Indian Chem. Soc., 1939, **16**, 385—388).—The dissociation const. of β-resorcylic acid (HX), determined by measuring the e.m.f. at 30° of cells of the type $H_2|HX,NaX,\ NaCl|AgCl\text{–}Ag$, is $6{\cdot}05 \times 10^{-4}$.
W. R. A.

Influence of neutral salts on the dissociation coefficients of ampholytes. I, II. A. P. KONIKOV (J. Gen. Chem. Russ., 1938, **8**, 1194—1203, 1204—1219).—I. The differences in tho dissociation coeffs. p_K of the NH_2 and CO_2H groups of NH_2-acids and peptides in solutions of KCl of ionic concns. μ_1 and μ_2 are given by $\Delta p_{K_{NH_2}} = -0{\cdot}5(1 - z^2) \times (\mu_2^{\frac{1}{2}} - \mu_1^{\frac{1}{2}})/Q_1Q_2 + C_N(\mu_2 - \mu_1)$, and $\Delta p_{H_{CO_2H}} = 0{\cdot}5(1 - z^2)(\mu_2^{\frac{1}{2}} - \mu_1^{\frac{1}{2}})/Q_1Q_2 - C_0(\mu_2 - \mu_1)$, where z is the "inactivation coeff.," representing the charge of the zwitterion, Q_1 and Q_2 are the vals. of $Q = 1 + 3{\cdot}3 \times 10^{-7}\alpha\mu^{\frac{1}{2}}$ at μ_1 and μ_2, respectively (α = ionic diameter), and C_N and C_0 are the "salting-out" coeffs. for the NH_2 and CO_2H group, respectively, and are characteristic of a given salt. The p_K of the ionogenic groups of glycine and mono-, di-, and tri-glycylglycine is much less affected by neutral salts than in the case of carboxylic acids, but the difference diminishes with increasing distance between the NH_2 and CO_2H groups.

II. The amount of acid or base bound during titration of a mixture of ampholytes is given by $M = \Sigma\alpha m$, where α is the dissociation coeff. of an individual ampholyte, and m is its mol. concn. The equations $\Delta = \log \alpha/(1 - \alpha)$ or $\log (1 - \alpha)/\alpha$, where $\Delta = p_H - p_K$, serve for derivation of α. Examples of the use of the equations in titration of solutions containing 1—5 NH_2-acids are given, for a p_H range of 0—14. R. T.

Dissociation constants and titration exponents of less common alkaloids. N. SCHOORL (Pharm. Weekblad, 1939, **76**, 1497—1501).—The following vals. are recorded for p_{K_1} and (for dibasic alkaloids) p_{K_2}: alypine (4·5, 10·2), aristoquin (—, 9), dicodide (6·05), dilaudide (6·2), β-eucaine (4·65), euquinine (7·15, 10·5), eucodal (5·4), heroin (6·4), homatropine (4·3), optoquin (5·5, 9·95), paracodine (6·05), scopolamine (6·45) stovaine (6·1), yohimbine (6·55, 11·0).
S. C.

Hydrogen-ion concentration of solutions containing zinc hydroxide and sodium hydroxide. S. M. MEHTA and M. B. KABADI (J. Indian Chem. Soc., 1939, **16**, 379—384).—$[H^{\cdot}]$ of solutions containing ZnO and Na_2O in various proportions has been determined with the glass electrode. When the concn. is <6N. Na zincate is largely hydrolysed but in conc. solutions hydrolysis is slight. The results indicate the possibility of isolating Na zincate from solutions of concn. >8N. and agree with those deduced by measuring the Λ of solutions (A., 1939, I, 471). W. R. A.

Equilibrium between the liquid and vapour phases of dilute solutions of methyl alcohol.

N. V. TSCHALOV and M. A. SOHOLINA (J. Appl. Chem. Russ., 1939, **12**, 1170—1171).—The [MeOH] of the vapour in equilibrium with aq. MeOH has been determined for 0·01—1% solutions, at room temp. (?)/1 atm. R. T.

Viscosity and m.p. in the system ethylenediamine–methyl alcohol. M. S. ELGORT (Bull. Univ. Asie Centr., 1937, No. 22, 227—237).—The m.p.– and η–composition curves suggest the *compound*, $(CH_2 \cdot NH_2)_2,2MeOH$, m.p. −48° (decomp.). R. T.

Thermal analysis of ketocineole–camphor systems. M. BRAMBILLA (Annali Chim. Appl., 1939, **29**, 506—512).—F.p.–composition curves for synthetic and *d*-camphor–ketocineole systems are given and discussed. No eutectic mixtures are detectable. The racemic and optically active forms of camphor show slightly different characteristics. F. O. H.

Influence of various elements on the system iron–ferrous sulphide. R. VOGEL (Naturwiss., 1939, **27**, 761—764).—A summary of work previously published. F. L. U.

Basic chlorides. I. G. B. FRIDMAN (J. Gen. Chem. Russ., 1939, **9**, 1598—1602).—The solid phases forming in the system $ZnCl_2$–ZnO–H_2O, at 30°, are $5ZnCl_2,5ZnO,8H_2O$, stable within the limits 57·7—71% $ZnCl_2$ in the aq. phase, a solid solution containing ≯56% of ZnO, stable between 57·7 and 9·28% of $ZnCl_2$, and a series of solid solutions containing ≯64% of ZnO, at 0—9·28% of $ZnCl_2$. Numerous double salts reported in the literature are in reality solid solutions. R. T.

Simultaneous solubility of aluminium, sodium, potassium, and ferric nitrates in water in presence of nitric acid. III. A. I. SASLAVSKI and J. A. RAVDIN (J. Gen. Chem. Russ., 1939, **9**, 1473—1478; cf. A., 1938, I, 198).—The solid phases in the system $Al(NO_3)_3$–$Fe(NO_3)_3$–H_2O, at 0°, 20°, and 40°, consist of an unbroken series of mixed crystals of $Al(NO_3)_3,9H_2O$ and $Fe(NO_3)_3,9H_2O$. The *d*–, *n*–, and m.p.–composition curves of the mixed crystals confirm the unlimited mutual solubility of their components. R. T.

Quaternary system CaO–Al_2O_3–$CaSO_4$–H_2O at 25°. F. E. JONES (Trans. Faraday Soc., 1939, **35**, 1484—1510).—The only quaternary compound found in this system is $3CaO,Al_2O_3,3CaSO_4,32H_2O$, which is incongruently sol. in H_2O and in dil. aq. $Ca(OH)_2$ or $CaSO_4$. It is stable in contact with conc. solutions of $CaSO_4$, but is only congruently sol. in aq. $Ca(OH)_2$ of a limited concn. range. The invariant point compositions in this system are tabulated. The nature of the Ca sulphoaluminate formed during the setting of Portland cement, and the attack of concrete by aq. $CaSO_4$, are discussed. J. W. S.

Heat of combustion of *iso*propyl alcohol. G. S. PARKS and G. E. MOORE (J. Chem. Physics, 1939, **7**, 1066—1067).—The heat of combustion of $Pr^{\beta}OH$ has been measured. $\Delta H_{298 \cdot 16} = -478,880$ g.-cal. per mol. at 25° and 1 atm. const. pressure. Combining this with the best val. for $Pr^{\alpha}OH$ (cf. Rossini, A., 1934, 1308), $\Delta H_{298 \cdot 16}$ of the isomerisation reaction $Pr^{\beta}OH$ (liq.) → $Pr^{\alpha}OH$ (liq.) is −3350 g.-cal. per mol., and since $\Delta S_{298 \cdot 16}$ for this reaction is −3·1 e.u., $\Delta G^{\circ}_{298 \cdot 16} = -2430$ g.-cal. per mol. W. R. A.

Entropy of dissolution. I. M. BARCLAY and J. A. V. BUTLER (Trans. Faraday Soc., 1938, **34**, 1445—1454).—Partial v.p. of CS_2, C_6H_6, $CHCl_3$, and PhCl in $COMe_2$ and in EtOH, and of SO_2, NH_3, and CCl_4 in EtOH were determined at 25° and 35°. Entropies (ΔS) and heats (ΔH) of vaporisation and other thermodynamic quantities are calc. The linear relationship between ΔS and ΔH is extended by these results to solutes having heats of dissolution of 4—10 kg.-cal., and is also found to hold for unassociated pure liquids. The abnormally high vals. of ΔS for solutes from associated liquids are connected with the abnormal surface entropies of cavities in these liquids indicated by the Ramsay–Eötvos relation. F. L. U.

Thermodynamics of cellulose nitration.—See B., 1940, 28.

Derivation of the criteria for irreversible changes, equilibrium, and stability, based on the uncompensated heat. P. VAN RYSSELBERGHE (J. Chem. Educ., 1939, **16**, 476—480).—Theoretical. L. S. T.

Assignment of uncertainties to the data of chemistry and physics, with specific recommendations for thermochemistry. F. D. ROSSINI and W. E. DEMING (J. Washington Acad. Sci., 1939, **29**, 416—441).—The application of the theory of probability to a set or sets of observations, functional concordance, the propagation and combination of errors, and application to measurements in general are discussed. Sp. recommendations for thermochemistry include a description and discussion of a procedure for combining standard deviations, and the assignment of an uncertainty interval to experimental vals. L. S. T.

Theory of electrical equilibrium of electrolytic conductors. D. CASTELLUCCIO (Nuovo Cim., 1939, **16**, 348—354).—Theoretical. O. J. W.

Determination of specific conductivity of very dilute solutions of certain electrolytes. B. P. TATARINOV and M. V. LEVITSKI (J. Gen. Chem. Russ., 1939, **9**, 1619—1621).—Sp. conductivity data are recorded for 0·000067—0·001N-Na_2CO_3, -NaCl, -Na_2SO_4, -$CaCl_2$, and -$MgSO_4$, all at 25°. R. T.

Specific conductivity in binary and ternary systems containing sodium and magnesium chlorides and sulphates. V. I. NIKOLAEV and I. S. KATIK (J. Gen. Chem. Russ., 1939, **9**, 1611—1618).—Sp. conductivity–composition curves are given for the binary systems Na_2SO_4–, NaCl–, $MgCl_2$–, and $MgSO_4$–H_2O, and for the ternary systems NaCl–$MgCl_2$–H_2O, $MgCl_2$–$MgSO_4$–H_2O, and NaCl–Na_2SO_4–H_2O, all at 25°. R. T.

Electrolytic conductivity and the hydrogen link. P. WULFF (Naturwiss., 1939, **27**, 661).—Investigation of the conductivity of mixtures of non-polar substances with alcohols shows that the mixture has a definite conductivity if the alcohol associates to give polar complexes. Conductivity in the system EtOH–C_6H_6 is due to minute traces of H_2O. An

explanation of this, involving the H link, is put forward. A. J. M.

Triple ions and transference numbers. M. Dole (Trans. Electrochem. Soc., 1939, **77**, Preprint 3, 39—48).—Theoretical. The effects of triple ion formation on transference nos. are analysed, and it is shown that, contrary to the opinion of those authors, the results of Lanning and Davidson (A., 1939, I, 147) for NH_4OAc in anhyd. AcOH are consistent with triple ion formation either if the negative triple ion is formed to an extent > the positive, or if they are formed in equal amounts but the negative triple ion has the greater mobility. F. J. G.

Behaviour of a platinum electrode, (A) during precipitation of barium sulphate, (B) in presence of foreign ions. I. L. Orestov (Bull. Univ. Asie Centr., 1937, No. 22, 177—184, 185—188).—Expressions connecting the potential of bright Pt electrodes with the ionic concns., during titration of $BaCl_2$ with K_2SO_4, or vice versa, are derived (cf. A., 1937, I, 364; 1939, I, 83). R. T.

Decomposition potential of carnallite melts. W. D. Treadwell and A. Cohen (Helv. Chim. Acta, 1939, **22**, 1341—1348).—The e.m.f. of Mg–Cl cells have been measured, using fused $MgCl_2$ and $MgCl_2$–KCl mixtures as electrolytes. The results accord with the decomp. potentials calc. from the equilibrium const. for the oxidation of these melts (A., 1939, I, 371). The relatively large increase in the e.m.f. produced by addition of KCl indicates the existence of complexes which decrease the rate of reaction between $MgCl_2$ and O_2. J. W. S.

Electron concentration cells and p_H measurement. V. Karpen (Compt. rend., 1939, **209**, 790—792; cf. A., 1939, I, 613).—In a cell consisting of similar metallic electrodes in contact with two adjoining electrolyte solutions which contain no ions of the metal, the e.m.f. (E) is determined by the electron concns. (ε') in the solutions; $E = RT \log (\varepsilon'_2/\varepsilon'_1)$. A p_H comparison with such a cell is in reality a comparison of ε vals.; saturation of the solutions with H_2 modifies the observed vals. to an increasing extent as neutrality is approached. A. J. E. W.

Electrochemical potentials and Volta effect. I. O. Scarpa (R.C. Atti Accad. Lincei, 1939, [vi], **29**, 441—451).—From a comparison of the electrochemical potentials and the Volta effect of metals the contact potential between pure Pt and Pt in equilibrium with H at n.t.p. is calc. to be ~0·5 v. The electrochemical potentials of the metals corr. for the Volta effect ("true normal potentials") are calc. O. J. W.

Determination of oxidation–reduction potential and calculation of results. H. Mohr (Biochem. Z., 1939, **302**, 220—225).—Procedure for securing greater accuracy in the determination of redox potentials is described. Mixtures of two redox systems and other special cases are considered. Equations required for the calculation are given. W. McC.

Oxidation–reduction potential of iodine. I. A. I. Rusanova (J. Gen. Chem. Russ., 1938, **8**, 1272—1278).—Allowing for complex ion formation, the E_h of the system I–I′ is given by the modified Nernst equation $E_h = 385 + 28{\cdot}75 \log x/y^2$, where x and y are the actual [I] and [I′] of the solution. Tables and graphs serving for the potentiometric determination of I and I′ are given. R. T

Electrolysis of sodium cuprocyanide solution. J. V. Petrocelli (Trans. Electrochem. Soc., 1940, **77**, Preprint 4, 49—57).—Anodic and cathodic polarisation curves for Cu in solutions of varying $Na_2Cu(CN)_3$ concn. have been determined. Fick's law of diffusion is applied to the interpretation of the kinetic electrode potentials. J. W. C.

Anodic behaviour of chromium. R. H. Roberts and W. J. Shutt (Trans. Faraday Soc., 1938, **34**, 1455—1469).—Cr anodes in acid chloride and sulphate solutions have been studied by means of oscillograms. Anodic passivation occurs only when a limiting c.d. C_0 is exceeded; the val. of C_0 depends on the temp. and composition of the electrolyte, especially on [H˙], and at any higher c.d. C, the time required for passivation is given by $t = X/(C - C_0)$, where X is the no. of coulombs required for passivation. In H_2SO_4 passivation occurs in three distinct stages. In HNO_3 or neutral salt solutions Cr passivates instantly with the smallest anodic current, and cathodic reduction shows that in such solutions the Cr carries a unimol. layer of oxide. The results indicate that the first effect of electrolysis is reduction of [H˙] in contact with the anode; this is followed by discharge of OH′ and formation of an oxide layer. F. L. U.

Influence of a magnetic field on chemical reactions, and A. N. Schtschukarev's magneto-chemical effect. A. N. Sisoev (J. Gen. Chem. Russ., 1938, **8**, 1247—1253).—Schtschukarev's magneto-chemical effect (A., 1925, ii, 47) is not actually a chemical effect, but a phenomenon connected with polarisation of the electrodes. R. T.

Hydrogen overvoltage on cadmium, with access of air. M. Straumanis and N. Brakšs (Z. physikal. Chem., 1939, **185**, 37—44).—Measurements with the cell Cd|0·1N-H_2SO_4|Zn show that access of O_2 considerably reduces the H overvoltage (η) at a Cd cathode (potential E), if the c.d. is < ~0·3 ma. per sq. cm.; segments of the E–I curve are approx. represented by $E = e^{(I - a_1)/b_1}$, although the curves are not reproducible owing to hysteresis effects. At higher c.d. (using an external source of current) insufficient O_2 is available to oxidise the H completely, and the normal H overvoltage curve ($\eta = a + b \log I$) develops; the transition is determined by the rate of diffusion of O_2 to the electrode and the catalytic activity of the surface (Pt > Fe > Ni > Cd). A. J. E. W.

Application of theory of absolute reaction rates to overvoltage. H. Eyring, S. Glasstone, and K. J. Laidler (J. Chem. Physics, 1939, **7**, 1053—1065).—Theoretical. By applying the theory of abs. reaction rates it has been shown that the c.d. and the overvoltage (η) of an electrode are related. A prototropic mechanism is proposed which explains the linear rate of attainment of η, the effect of changes in ζ-potential, and the reason for the low η of metals

forming strong M–H bonds. The influence of the cathode material and temp. on the H_2–D_2 separation is discussed. Explanations of O viscosity, and the high η in the discharge of $H_3O^{\cdot}$ and OH' are suggested.
W. R. A.

Electrode equations for analysis of redox titration curves. A. GEAKE (Trans. Faraday Soc., 1938, **34**, 1395—1409).—New equations are given for redox systems in which semiquinone formation occurs and for mixtures of two simple systems. They have practical advantages over the older equations, and can be used to calculate semiquinone formation consts. and normal potentials of mixed redox systems.
F. L. U.

Electrolytic reduction of dicyanogen, oxamic acid, and oxamide on a mercury dropping cathode. J. BŘEZINA and J. HEYROVSKÝ (Časop. Českoslov. Lék., 1937, **17**, 274—280).—As current–voltage curves obtained in the electrolysis of freshly prepared $Cu(CN)_2$ solutions in excess of KCN show irregularities due to the formation of CuCN and free C_2N_2 the effect of C_2N_2 absorbed in neutral, slightly acidic, and alkaline solutions of various electrolytes is studied. C_2N_2 in aq. NaOAc causes an increase of current at the potential of the dropping Hg cathode $-1{\cdot}15$ v. (N-calomel $= 0$) due to the direct electro-reduction of the C_2N_2 gas absorbed, ($C_2N_2 + 2O \rightarrow 2CN'$) and another increase at $-1{\cdot}55$ v. due to the electro-reduction of the amidic product of hydrolysis of C_2N_2, probably $(CO{\cdot}NH_2)_2$,$NH_2{\cdot}CO{\cdot}CO_2H$ or its salt, the mol. taking up 2 *e*. This supports the view that dipole mols. with double linkings are adsorbable and electro-reducible at the dropping Hg cathode.
F. R.

Extinction limits of flames. W. P. JORISSEN (Chem. Weekblad, 1939, **36**, 815—820).—A review containing new data on the following systems, the limiting concns. of the gas maintaining combustion being determined from the extinction of the flame of the pure combustible gas or of O_2 in the case of the reverse flame, from the peak of the explosion region, and from the tangents to the explosion limit curves: H_2 in O_2–N_2 (5·0, 5·4, 5·2), O_2–CO_2 (10·0, 10·9, 10·8), O_2–A (4·1, 4·1, 4·0); O_2 in H_2–N_2 (10·0, 10·8, 10·0), H_2–CO_2 (14·5, 15·2, 15·1), H_2–A (7·5, 8·1, 7·7), CH_4–N_2 (8·2, 7·7, 8·1), CH_4–CO_2 (12·5, 11·5, 13·6), CH_4–A (5·9, 5·8, 5·5), NH_3–N_2 (32·5, 27·4, 35·4), NH_3–A (27·6, 24·8, 30·0); CH_4 in O_2–N_2 (16·6, 15·4, 16·0), O_2–CO_2 (25·3, 23·3, 25·7), O_2–A (12·4, 11·2, 11·2); NH_3 in O_2–N_2 (28·0, 24·6, 32·6), O_2–A (22·5, 22·1, 28·3% of the first mentioned component of the binary mixture) Errors due to the effect of the explosion vessel are most marked in the case of systems containing NH_3.
S. C.

Spectroscopic study of the combustion of methane. E. M. GUÉNAULT (17th Ann. Rept. Safety in Mines Res. Bd., 1938, 53—54).—The occurrence of the system of diffuse bands due to an activated form of CH_2O mol. in the spectrum of MeOH flames, and its absence from the spectra of CH_4 and CH_2O flames, has been confirmed. Photomicrometric records show that the band system due to the radical CHO is more prominent in the spectrum of the CH_4 flame than in that of MeOH. Proof has been obtained of the occurrence of CH bands in the spectrum of flames of CH_2O.
R. B. C.

Ignition temperatures of methane in air.—See B., 1940, 7.

Kinetics of slow oxidation of ethylene. M. V. POLJAKOV and F. M. VAINSTEIN (Acta Physicochim. U.R.S.S., 1939, **11**, 415—426).—Measurement of the rate of oxidation of C_2H_4 by O_2 at 700—800° in quartz vessels of different dimensions and in presence of Pt of varying surface area leads to substantially the same conclusions as did similar experiments with H_2 and with CH_4 (A., 1939, I, 203). Under the conditions used the reaction is always incomplete.
F. L. U.

Kinetics of slow oxidation of carbon monoxide. A. V. KORNEIEVA and M. V. POLJAKOV (Acta Physicochim. U.R.S.S., 1939, **11**, 427—442).—The slow oxidation of CO by O_2 has been studied at 450—800° and 30 mm. ($<$ limiting ignition pressure) in a quartz vessel and in presence of Pt wires of varying length. At 450° the reaction is heterogeneous, its rate increasing with increasing area of Pt; above 600° it becomes homogeneous as well, as with the slow oxidation of H_2, CH_4, and C_2H_4 (cf. preceding abstract). The reaction is not complete at any of the temp. used. A chain mechanism is shown to be probable in the heterogeneous catalysis.
F. L. U.

Mechanism of formation of nitrogen oxides in the explosion of combustible mixtures. II. M. V. POLJAKOV and R. I. GENKINA (Acta Physicochim. U.R.S.S., 1939, **11**, 443—452).—Further experiments with a mixture of composition CH_4 22, O_2 53, N_2 25% in vessels with different diameters show that, as required by the authors' theory (cf. A., 1939, I, 569), the yield of NO passes through a max. with increase of diameter at a given pressure, and with increase of pressure for a given diameter.
F. L. U.

Kinetics of cracking of hydrocarbons under pressure. IV. Cracking of olefines, diolefines, and cyclic unsaturated hydrocarbons. M. D. TILITSCHEEV (J. Appl. Chem. Russ., 1939, **12**, 1154—1169).—On the basis of published data it is shown that at $<500°$ the reaction of cracking of olefines is one of the second order, whilst at $>600°$ it is of the first order. At $<500°$ the velocity coeff. k falls with increasing mol. wt. from C_2H_4 to hexene, thereafter rising; the activation energy E is $\sim$40 kg.-cal. per g.-mol. in all cases. At $>600°$ k rises rapidly with rising mol. wt. At high pressures (20 atm.) the stability of olefines is $>$ of paraffins at $>600°$, but $<$ of paraffins at $<500°$. The reaction of cracking of diolefines is of the second order at 300—700°; E is 25—26 kg.-cal. per g.-mol. in all cases. The velocity of polymerisation of styrene is 2000 times that of 1-$C_{10}H_7{\cdot}CH{:}CH_2$.
R. T.

Decomposition of alkyl peroxides: di[-*n*-]propyl peroxide, ethyl hydrogen peroxide, and propyl hydrogen peroxide. E. J. HARRIS (Proc. Roy. Soc., 1939, **A**, **173**, 126—146).—The thermal decomp. of Pr_2O_2 is a homogeneous, unimol. reaction below a crit. pressure; above this pressure explosive decomp. takes place with the formation of C_4H_{10}

and CH_2O. The products of the slow decomp. are complex. The decomp. of EtO_2H and PrO_2H is heterogeneous. The reaction products include aldehydes and alcohols and at low temp. O_2 is found. All the peroxides ignite in air at very low pressures in the temp. range 200—300°. G. D. P.

Thermal decomposition of acetone. J. G. DAVOUD and C. N. HINSHELWOOD (Nature, 1939, **144**, 909—910).—The view that the thermal decomp. of $COMe_2$ is a chain reaction is criticised. Instead of a delay in the pressure increase corresponding with an induction period (cf. A., 1939, 939), a decrease in pressure has been observed with 300 mm. of $COMe_2$ in a 250-c.c. SiO_2 bulb at 460°. L. S. T.

Thermal decomposition of diacetyl. F. O. RICE and W. D. WALTERS (J. Chem. Physics, 1939, 7, 1015—1018).—Using a static method the thermal decomp. of Ac_2 has been investigated from 424° to 470°. The reaction, as measured by pressure change in the reaction vessel, is of first order and is only slightly affected by a large increase in the surface-vol. ratio of the vessel. The products of the reaction and the pressure increase indicate the over-all reaction $Ac_2 \rightarrow CH_4 + CO + CH_2{:}CO$, followed by some decomp. and polymerisation of keten. A free radical mechanism of the decomp. which does not account for the observed high frequency factor ($\sim 10^{17}$) is suggested. W. R. A.

Oxidation of the aldoses by hypoiodite. VI. Oxidation of glucosone (2-ketoglucose) by hypoiodite. K. MYRBÄCK (Svensk Kem. Tidskr., 1939, **51**, 225—229; cf. A., 1939, I, 615).—The ratio of the rate of oxidation of glucosone to the rate of oxidation of glucose is <1 in slightly alkaline solution, ~ 1 in 0·03N-NaOH, and increases with increasing [OH′]. F. J. G.

Kinetics of exchange reactions. II. *n*-Propyl, *iso*propyl, and *iso*butyl bromides. G. A. ELLIOTT and S. SUGDEN (J.C.S., 1939, 1836—1838).—The kinetics of exchange reactions of $Pr^{\alpha}Br$, $Pr^{\beta}Br$, and $Bu^{\beta}Br$ with Br′ in 90% $COMe_2$ have been examined. The activation energy (E) increases on passing from $Pr^{\alpha}Br$ to $Bu^{\alpha}Br$ (A., 1939, I, 526), whilst the effective collision diameter (A) falls. The *iso*-compounds have high vals. for E and A, A for $Pr^{\beta}Br$ being unusually high. C. R. H.

Oxidation of carbon by nitrous oxide. R. F. STRICKLAND-CONSTABLE (Trans. Faraday Soc., 1938, **34**, 1374—1384).—The main reaction between N_2O and C at 400—450° is predominantly of the first order, and gives CO_2 and N_2 with very little CO. The reaction is retarded, slightly at 400° and markedly at 450°, both by the reaction products and by pure N_2 to the same extent, and the action is therefore regarded as purely physical. The heat of activation is $\sim$30 kg.-cal. CO reacts rapidly with N_2O at 400° in presence, but not in absence, of C. A subsidiary reaction of N_2O with C gives solid surface oxides, only a small proportion of which is of the Schilov type (A., 1930, 1108, 1246). F. L. U.

Growth of crystals from a stream of vapour. R. N. HAWARD (Trans. Faraday Soc., 1939, **35**, 1401—1413).—The rate of growth of crystals in a vapour stream of known density has been studied for salicylic acid (I), HgI_2, anthracene, I, and SnI_4, but in no case can the results be expressed on the basis of a const. condensation coeff. For (I) the observations are explained by a bimol. process occurring in a mobile surface phase, a theory which is shown to be in accord with the crystal structure. The results with the other vapours indicate that thick layers of disarranged mols. may be built up on the surface of growing crystals. J. W. S.

Rate of xanthation of soda-cellulose.—See B., 1940, 27.

Velocity of detonation of mixtures of solid explosives with non-explosive liquids.—See B., 1940, 90.

Effect of carbon content on rate of oxidation of steel in air at high temperatures.—See B., 1940, 44.

Decomposition of hydrogen peroxide by catalase. J. WEISS and H. WEIL-MALHERBE (Nature, 1939, **144**, 866; cf. A., 1940, I, 32).—Further quant. experiments show that catalase activity does not depend on the presence of O_2, the rate of decomp. of H_2O_2 being the same in presence or absence of O_2. The agrees with the theory proposed recently by Weiss (A., 1938, III, 72), but not with the mechanism put forward by Keilin and Hartree. L. S. T.

Racemisation of optically active co-ordination compounds. Application of the Arrhenius equation. E. BUSHRA and C. H. JOHNSON (J.C.S., 1939, 1937—1945).—The racemising properties of the optically active ions, $[M(C_2O_4)_3]'''$, $[M\,en(C_2O_4)_2]'$, and $[M\,en_2(C_2O_4)]^{\cdot}$ ($M = Cr^{\cdot\cdot\cdot}$ or $Co^{\cdot\cdot\cdot}$) have been investigated. Inversion occurs by intramol. rearrangement of the co-ordinated radicals. The rate of inversion of $[Cr(C_2O_4)_3]'''$ (I) is 20 times that of $[Co(C_2O_4)_3]'''$ (II) at 18°. Although a difference of 1·7 kg.-cal. in the activation energies (E) would account for this, the actual vals. of E differ by $\sim$10 kg.-cal., and vals. of PZ differ by a factor of 10^6, the effect being mutually compensating. The catalytic effect of salts on racemisation has been studied. In general, high concns. of univalent cations accelerate racemisation of (I) and (II) and have no effect on $[Cr\,en(C_2O_4)_2]'$ (III), whilst low concns. of multivalent cations accelerate the racemisation of (I) and (III) and have no effect on (II). Catalytic activity diminishes with increasing size of the cation. These effects are even more pronounced in aq. $COMe_2$. (III) has been resolved with the aid of brucine. C. R. H.

Effect of mercuric bromide on the hydrolysis of alkyl bromides in acetone. D. R. READ and W. TAYLOR (J.C.S., 1939, 1872—1878).—$HgBr_2$ accelerates the hydrolysis of MeBr, EtBr, $Pr^{\beta}Br$, and $Bu^{\gamma}Br$ in aq. $COMe_2$, the effect increasing in that order. H_2O has a similar but smaller accelerating effect. $HgBr_2$ is deactivated by the HBr liberated during the reaction. Since $HgBr_2$, which is electrophilic, accelerates and nucleophilic agents decrease the hydrolysis rate, it is suggested that the behaviour of H_2O, which for some bromides accelerates and for

others decreases hydrolysis rates, is due to it possessing both electrophilic and nucleophilic properties, the effective property depending on the nature of the reacting bromide. Relevant phenomena are discussed. C. R. H.

Catalyst poisoning from the point of view of the specificity of active centres. XI. Relative adsorption coefficients of hydrogen in alcohol dehydrogenation on copper. A. Bork (Acta Physicochim. U.R.S.S., 1939, **11**, 409—414).—It is shown by experiments with EtOH vapour and Cu at 257·5° that the const. k in the velocity equation (cf. A., 1936, 1076, 1472) contains no adsorption magnitudes. F. L. U.

Exchange reaction between ammonia and hydrogen in the presence of platinum catalyst. I. M. Mitani (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 879—883).—The reaction between H_2–D_2 and NH_3 in presence of Pt-black at —20°, 0°, 20°, and 50° was followed by the decrease in the $[D_2]$ of the gas, confirming the theoretical prediction of the exchange reaction. No confirmation was obtained of the prediction that the evaporation of the liquid NH_3 in contact with the catalyst decreases the reaction rate. This was attributed to the adhesion of the liquid NH_3 by capillary condensation to the surface of the Pt-black. D. F. R.

Effect of water vapour and carbon dioxide on oxidation of sulphur dioxide by vanadium pentoxide catalyst.—See B., 1940, 35.

Mechanism of catalytic phenylation and its inhibition by iron.—See B., 1940, 19.

Electrolytic processes at the anode as reactions of hydroxyl. A. Klemenc (Z. physikal. Chem., 1939, **185**, 1—36).—The active agent in electrolytic oxidation processes is electrically neutral OH resulting from the primary anode process. The overvoltage at a Pt anode depends on the stationary [OH] and is determined by the formation of Pt oxides, which is considered in detail. A quantum-mechanical treatment shows that the overvoltage is an essential feature of the electrode process. The rate of homogeneous oxidation by OH is approx. ∝ the current, and falls as the square of the distance from the anode surface; the [OH] on the surface is 0 owing to formation and decomp. of H_2O_2. Application of the theory to current–potential (I–E) curves shows that the anodic oxidation of quinol occurs without direct intervention of the Pt oxides, so long as no O_2 is evolved. In general, the electrode is or is not involved in the oxidation process according as dE/dT is $<$ or $>$ 0. The oxidation of $H_2C_2O_4$ is initially a homogeneous reaction with OH, the rate being independent of $[H_2C_2O_4]$; when a crit. concn. of Pt oxide is reached the reaction abruptly becomes a heterogeneous first-order process at the electrode. The effect of temp. and activation energy is considered. The theory is also discussed with reference to the oxidation of H_2SO_4, H_2SO_3, $Na_2S_2O_3$, and aliphatic acids. Evidence is given that $H_2S_2O_8$ and H_2O_2 react as HSO_4 and OH. A. J. E. W.

Change in the rate of dissolution of copper during anodic and cathodic polarisations. Difference effect. Protective effect. N. D. Tomaschov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 152—155).—The rate of dissolution of Cu in N. and 0·1N. aq. $(NH_4)_2S_2O_8$ and in 0·8N. aq. $CuCl_2$ increases with increasing anodic polarisation and decreases with increasing cathodic polarisation. The rate of auto-dissolution of Cu (*i.e.*, the rate of dissolution determined by the operation of local micro-elements) depends on the character of the current charge imposed, and for N. and 0·1N. aq. $(NH_4)_2S_2O_8$ it decreases with anodic polarisation (positive difference effect) and cathodic polarisation (positive protective effect). On the other hand, with 0·8N. aq. $CuCl_2$ an increase in the rate of auto-dissolution of Cu is observed for both anodic (negative difference effect) and cathodic polarisation (negative protective effect). The change of the potential of the Cu electrode during cathodic polarisation is ≫ that during anodic polarisation. Dissolution of Cu (and probably other noble metals) in oxidising media may thus be explained on the basis of the general electrochemical theory of the corrosion of metals. W. R. A.

Electrolytic preparation of molybdenum phosphides. J. L. Andrieux and M. Chêne (Compt. rend., 1939, **209**, 672—674).—Electrolysis of a fused mixture of $NaPO_3$ (102 g.), NaCl (6 g.), and MoO_3 (x g.) at 800°, using a C rod as anode and the C crucible as cathode (c.d. 0·2 amp. per sq. cm.; 12 v.), affords MoP, *Mo_3P*, products of intermediate composition, or MoO_2 (x <4, >11, 4—11, or >27, respectively). Mo_3P has d 6·7; both phosphides resist attack by HCl, but are decomposed by H_2SO_4, HNO_3, fused alkalis, and oxidising agents. A. J. E. W

Electrolytic production of manganese.—See B., 1940, 48.

Electrolytic reduction of ferric sulphate in presence of titanium sulphate.—See B., 1940, 57.

Action of helium on polonium under the influence of the electric discharge. R. Méndez (Anal. Asoc. Quím. Argentina, 1939, **27**, 130—139).—He reacts at 100° with Po vapour in a high-frequency discharge tube to give a radioactive gas which ionises N. This result is analogous to that obtained by Morrison (A., 1928, 684) with Ra-D and -E. F. R. G.

Photochemical oxidation of hydrogen. I. A. B. Nalbandjan (Acta Physicochim. U.R.S.S., 1939, **11**, 453—474).—Oxidation of H_2 by O_2 at 20—40 mm. in light of λ 1750—1300 A. yields H_2O and O_3. The reaction rate ∝ the intensity of illumination, and increases with increase of total pressure to a const. val. which depends on the dimensions of the reaction vessel and on $[O_2]$. An expression is derived for the reaction rate; it represents the variation of the latter with pressure and permits the calculation of the probability of interaction between a H and an O atom. The val., 10^{-6}, agrees with that obtained by Harteck and Kopsch (A., 1931, 809). The amounts of H_2O and O_3 formed in a mixture of given composition, calc. according to an assumed reaction scheme, agree with experimental vals. The yield for $2H_2 + O_2$ is ~2 mols. per quantum of energy absorbed. O_3 forms ~6 mol.-% of the total products

when the composition is $2H_2+O_2$, and $\sim 50\%$ when it is $4H_2+O_2$. F. L. U.

Photochemical reactions under high pressure. K. PETERS (Brennstoff-Chem., 1939, **20**, 356—358).—By enclosing a quartz Hg-vapour lamp in a steel pressure vessel it was found possible to study photochemical reactions at gas pressures up to 50 atm.; by suitably modifying the design of the lamp higher pressures could probably be used. Preliminary experiments with various gas mixtures, *e.g.*, $CO + H_2$, $CO_2 + H_2$, $CH_4 + O_2$, etc., at 20—100° were carried out. Small quantities of aldehydes and acids were formed. The formation of O_3 from O_2 was greatly accelerated by increase of pressure. The steel vessel had to be lined with Al, or preferably Ag, to prevent the otherwise very considerable rusting of the metal. A. B. M.

Thermal and photochemical oxidation of the chlorinated silanes. H. J. EMELÉUS and A. J. E. WELCH (J.C.S., 1939, 1928—1937).—Data for the photochemical and thermal oxidation of SiH_3Cl, SiH_2Cl_2, and $SiHCl_3$ are presented. As SiH_4 is progressively chlorinated, inflammability decreases. The oxidation of SiH_3Cl is similar to that of SiH_4 in that it shows the characteristics of a branching chain reaction, but the ignition of SiH_3Cl is characterised by short induction periods. SiH_2Cl_2 gives two lower explosion limits (cf. H_2S and CH_4). The oxidation of $SiHCl_3$ shows the characteristics of a chain reaction with degenerate branching. Analysis of the products of the photochemical oxidation of $SiHCl_3$ yields a volatile liquid condensable at —70° with the formula *$Si(OH)Cl_3$*. The data are discussed with reference to similar data for chlorinated hydrocarbons. C. R. H.

Influence of pressure and development on solarised latent photographic image. A. J. REARDON (J. Opt. Soc. Amer., 1939, **29**, 427—431).—The density obtained by both chemical and physical development after exposure up to the region of the first reversal is decreased by the application of pressures $\not> 1360$ kg. per sq. cm. during exposure. Pressure causes a marked acceleration of reversal. The effect of pressure is more marked with physical development, with which reversals are not found. L. J. J.

Two-quanta hypothesis applied to photographic reciprocity law failure. L. SILBERSTEIN (J. Opt. Soc. Amer., 1939, **29**, 432—447).—Theoretical. L. J. J.

Photo-sensitivity of Becquerel cuprous oxide electrodes. E. G. MISELIUK (Mem. Phys. Kiev, 1939, **8**, 17—26).—Bright Cu_2O coatings giving the Becquerel effect were obtained by quenching heated Cu electrodes in boiling H_2O or aq. $Pb(NO_3)_2$. The Becquerel effect is supposed to be a barrier-layer phenomenon, and to be connected with polarisation of the surface. R. T.

Helium and the rare gases. Emission of ultraviolet rays in the thermal decomposition of helium–platinum compounds. R. AUDUBERT, R. R. DE PIROSKY, and H. DAMIANOVICH (Anal. Asoc. Quím. Argentina, 1939, **27**, 127—129).—Emission occurs at the temp. of max. thermal decomp. and of greatest *d* of the HePt–Pt, confirming the existence of a compound between He and Pt. F. R. G.

Production of krypton and xenon.—See B., 1940, 37.

Experiments with atomic hydrogen: search for higher hydrides of nitrogen, phosphorus, and sulphur. K. G. DENBIGH (Trans. Faraday Soc., 1939, **35**, 1432—1435).—NH_3, PH_3, and H_2S, when brought into contact with at. H, cause recombination of the atoms, PH_3 and H_2S also undergoing decomp., but there is no evidence of the formation of higher hydrides. Possible reasons for the non-existence of hydrides corresponding with PF_5 and SF_6 are discussed. J. W. S.

Co-ordinated copper compounds with propylenediamine.—See A., 1940, II, 38.

Action of chlorine on calcium oxide. M. LEMARCHANDS and E. M. UMANA (Compt. rend., 1939, **209**, 757—759).—The replacement of H_2O by Cl_2 on chlorination at room temp. is studied using CaO of different degrees of hydration [$x = 5{\cdot}8$—85% of H_2O required to form $Ca(OH)_2$]. The proportion of H_2O replaced is nearly independent of x if x is $< 45\%$, but increases for higher x vals. The results are in accord with the mechanism $Ca(OH)_2 + Cl_2 = CaOCl_2 + H_2O$; the H_2O formed combines with a further mol. of CaO, if available, and enables chlorination to proceed. A. J. E. W.

Preparation of zinc chromates.—See B., 1940, 63.

Periodates of yttrium, erbium, and cerium. R. K. BAHL and S. SINGH (J. Indian Chem. Soc., 1939, **16**, 375—378).—By the action of paraperiodic acid on $Y(OAc)_3$ or $Ce(NO_3)_3$ the tetrahydrated mesoperiodate, $MIO_5,4H_2O$, is formed. There is no action with $Er(NO_3)_3$. Na_2 paraperiodate (I) and $Y(OAc)_3$ yield white amorphous *Y diorthoperiodate endecahydrate*, $Y_4I_2O_{13},11H_2O$. (I) and $Er(NO_3)_3$ or $Ce(NO_3)_3$ yield the mesoperiodate. The compound $3Y_2O_3,2I_2O_7,6H_2O$, reported by Cleve (Bull. Soc. chim., 1874, **21**, 196) could not be obtained. W. R. A.

Germanium: theories of organic and inorganic chemistry. A. TCHAKIRIAN (Ann. Chim., 1939, [xi], **12**, 415—499).—Details of work already noted (A., 1928, 380; 1930, 177; 1931, 322; 1933, 579; 1934, 942; 1935, 51, 1053; 1937, I, 193; II, 217) are given. Ge may be conveniently extracted from minerals by conversion into oxide, dissolution of this in $NH_4HC_2O_4$, pptn. of other metals by H_2S, and finally reconversion of Ge into GeO_2 by evaporation with H_2SO_4. GeI_4 may be obtained by direct action of HI on GeO_2 and extracted with $CHCl_3$. Analogies within the family C, Si, Ge, Sn are discussed, and a modified formulation of certain org. compounds, with a variable electrovalency for C, is proposed. F. J. G.

Chromatographic methods in inorganic chemistry. H. ERLENMEYER and H. DAHN (Helv. Chim. Acta, 1939, **22**, 1369—1371).—8-Hydroxyquinoline, preferably mixed with kieselguhr, can be used as an adsorption medium in the chromatographic separation of metals. The reagent is packed in small tubes,

5—6 cm. long and of 3 mm. bore, and is used in the same way as is Al_2O_3 in Schwab's method (A., 1937, I, 150). Coloured adsorbed compounds are formed in the tube by various ions in the order VO_3' (grey-black), WO_4'' (yellow), $Cu^{\cdot\cdot}$ (green), $Bi^{\cdot\cdot\cdot}$ (yellow), $Ni^{\cdot\cdot}$ (green), $Co^{\cdot\cdot}$ (reddish), $Zn^{\cdot\cdot}$ (yellow, with intense green fluorescence), $Fe^{\cdot\cdot\cdot}$ (black), and $UO_2^{\cdot\cdot}$ (reddish-orange). This order is in accord with the solubilities in H_2O of the products obtained and varies slightly with the p_H of the solution used. J. W. S.

Complexes formed by molybdic acid in aqueous solution. (MME.) H. FREY (Compt. rend., 1939, **209**, 759—760).—The cryst. additive *compounds* $2MoO_3,R,nH_2O$ have been prepared by the action of aq. molybdic acid on R = glycine, $(CH_2)_6N_4$, antipyrine, glyoxaline, and *d*-arabo-tetrahydroxybutyl-4-(or -5-)glyoxaline (I) (n = 1, 3, 1, 1, 2, respectively). The absorption speotra show the presence of Mo_2O_7'' in the mols. Conductometric titration indicates that the (I) compound is a perfect complex with acidic properties, the 0·01M. solution having p_H 2·8; it forms a stable NH_4 salt and probably has the constitution $H[HMo_2O_7,C_7H_{12}O_4N_2]$. The other compounds are imperfect complexes which are decomposed by dil. alkalis. A. J. E. W.

Study of the corrosion of iron by electron diffraction. S. MIYAKE (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 363—370).—Immersion of Fe in 1% NaCl for 1—20 hr. produces under the uppermost layer of γ-Fe_2O_3,H_2O a substance having two strong rings in the diffraction pattern. Its composition is intermediate between the γ-Fe_2O_3,H_2O and the γ-Fe_2O_3 formed with longer immersion, and closely resembles the film of Bengough's film theory. With immersion of 80—100 hr. α-Fe_2O_3,H_2O and a small amount of $Fe(OH)_2$ are detected. D. F. R.

Stereochemistry of complex inorganic compounds. V. Reaction of carbonates with dichlorodipropylenediamine cobaltic chloride. New method of determining relative configurations. J. C. BAILAR, jun., and J. P. MCREYNOLDS (J. Amer. Chem. Soc., 1939, **61**, 3199—3203; cf. A., 1939, I, 576).—(*a*) Addition of Ag_2CO_3 (1·2 mol.) to *cis*-[Co *l*-pn_2Cl_2]Cl (pn = $NH_2\cdot CHMe\cdot CH_2\cdot NH_2$) in H_2O, (*b*) allowing [Co *l*-pn_2Cl_2]Cl (I) to aquate (24 hr.) and then adding Ag_2CO_3 (excess), or (*c*) adding < the theoretical amount of K_2CO_3 to (I) gives the stable *salt*, [Co_D *l*-pn_2CO_3]$_2CO_3$. Grinding dry (I) with Ag_2CO_3 paste (excess) or using more K_2CO_3 gives a rapid reaction, producing an unstable *salt*, [Co_L *l*-pn_2CO_3]$_2CO_3$. Structures are assigned from the rotatory dispersion curves. Grinding dry *cis*-[Co *l*-en_2Cl_2]Cl [en = $(CH_2\cdot NH_2)_2$] with a large excess of K_2CO_3 gives an excess of the inverted carbonate. It is postulated that direct interaction gives the inverted form and that the non-inverted form is produced only after preliminary displacement of the Cl by H_2O. R. S. C.

Cobalt salts of glyoximes.—See A., 1940, II, 46.

Chemistry and morphology of basic salts of bivalent metals. VII. Basic nickel chlorides. VIII. Basic nickel bromides. W. FEITKNECHT [with A. COLLET] (Helv. Chim. Acta, 1939, **22**, 1428—1444, 1444—1455; cf. A., 1938, I, 91).—VII. The products obtained by incomplete pptn. of $NiCl_2$ with NaOH at various concns. have been examined by *X*-ray methods. Conc. (4M.) aq. $NiCl_2$ redissolves the initially pptd. $Ni(OH)_2$, forming unstable solutions, probably containing complex ions, which gradually deposit basic chlorides. In contact with dil. (0·2M.) aq. $NiCl_2$ the basic chlorides are converted into $Ni(OH)_2$, with decrease in p_H to ~7. From the variation of the [$Ni^{\cdot\cdot}$] with the p_H of these solutions the solubility product of $Ni(OH)_2$ is calc. to be $1\cdot1 \times 10^{-16}$. Examination of the products obtained on ageing the ppts. in contact with various solutions and at various temp. indicates the existence of basic chlorides varying in composition from $NiCl_2,Ni(OH)_2$ to $NiCl_2,6$—$7Ni(OH)_2$, five of which are chemical individuals which vary slightly in composition but exhibit characteristic forms and distinct *X*-ray structure.

VIII. Incomplete pptn. of $NiBr_2$ with NaOH, followed by ageing of the ppt. in contact with various solutions, leads to the formation of basic bromides varying in composition from $NiBr_2,2Ni(OH)_2$ to $NiBr_2,7Ni(OH)_2$, six of which appear to be chemical individuals with characteristic forms and *X*-ray spectra. J. W. S.

Determination of small quantities of free chlorine in phosgene.—See B., 1940, 36.

Colorimetric determination of chlorine in water.—See B., 1940, 94.

Determination of dissolved oxygen [in water].—See B., 1940, 94.

Determination of active oxygen in alkali peroxides.—See B., 1940, 35.

Separation of mixtures of gases by adsorption methods.—See B., 1940, 36.

Determination of boron in soils and plants.—See B., 1940, 73.

[Colorimetric determination of silicon in aluminium etc.]—See B., 1940, 47.

Determination of carbon dioxide in aqueous solution. J. R. I. HEPBURN (J.S.C.I., 1939, **58**, 340—342).—Apparatus suitable for the determination of free and combined CO_2 in aq. solution is described. The method used is based on that previously described (B., 1927, 42) for the determination of CO_2 in solid carbonates, and consists essentially in the liberation of the CO_2 in an apparatus under reduced pressure, absorption of the evolved CO_2 in 0·1N-$Ba(OH)_2$ solution, and back-titration with standard $H_2C_2O_4$. The accuracy is of the same order as for the earlier method, viz., within 0·5% of the true CO_2 content.

Determination of carbon dioxide in ammoniacal solutions and analysis of carbonate–carbamate mixtures.—See B., 1940, 35.

Composition of lithium and potassium salts precipitated by uranyl acetate reagents for sodium. E. R. CALEY and W. O. BAKER (Ind. Eng. Chem. [Anal.], 1939, **11**, 604—607).—The ppts. formed with $Li^{\cdot}$ and Mg, Co, Ni, Fe^{II}, and Mn uranyl acetates

have the composition $LiR^{II}(UO_2)_3(OAc)_9,nH_2O$, where n is 6, 6—7, 6—7, 9, and 6—7 for the Mg, Co, Ni, Fe^{II}, and Mn salts, respectively. Composition is independent of minor variations in the compositions of the reagents, and of wider variations in the vol. and concn. of the solutions containing $Li^{\cdot}$. The H_2O contents of the ppts. vary slightly with the conditions of drying, but approximate to $6H_2O$ at 100—105°. No ppts. were formed with conc. solutions of LiOAc and Cd, Hg^{II}, or Cu uranyl acetate reagents. The Mg, Ni, and Co reagents have the same sensitivity towards $Li^{\cdot}$ (2 mg. of $Li^{\cdot}$ in 1 ml. of aq. LiCl +5 ml. of reagent), and are more sensitive than the Zn or Mn reagent. They are also more sensitive towards $Na^{\cdot}$ (0·1 mg. of $Na^{\cdot}$ in 1 ml. of aq. NaCl +5 ml. of reagent) than are the Zn, Mn, Cu, and Cd reagents. As the Cu reagent is moderately sensitive towards $Na^{\cdot}$ (1 mg. of $Na^{\cdot}$ in 1 ml. of aq. NaCl +5 ml. of reagent) and gives no ppt. with $Li^{\cdot}$, it is a useful qual. reagent for $Na^{\cdot}$. The same salt, $KUO_2(OAc)_3$, is pptd. from conc. aq. KCl by the Mg, Ni, and Zn reagents. L. S. T.

Fractional centrifuging as a means of separating the constituents of a mixture. A. GOUREVITCH (Ann. Chim. Analyt., 1939, [iii], **21**, 291).—In order to separate a mixture of KCl and $K_2Cr_2O_7$, the solution is evaporated to dryness, the residue is mixed with 9 times its wt. of thymol and with glass balls, and shaken on a rotating shaker for 3—4 days. The mixture of thymol, KCl, and $K_2Cr_2O_7$ is centrifuged with a mixture of $CHBr_3$ and C_9H_{20} of ρ between that of KCl and $K_2Cr_2O_7$. The thymol dissolves in the solvent, the KCl floats on the surface, and the $K_2Cr_2O_7$ remains as a sediment. L. S. T.

Spectrographic determination of cæsium, rubidium, potassium, and lithium by the flame method. V. GAZZI (Annali Chim. Appl., 1939, **29**, 500—506).—Apparatus and technique are described. Data showing the relationship between concn. of element and line intensity are tabulated.

F. O. H.

Reactions between electrolytes and proteins. IV. Reactions with calcium and magnesium: methods. E. J. BIGWOOD (Bull. Soc. Chim. biol., 1939, **21**, 1102—1104; cf. A, 1939, I, 417).—Ca is determined in presence or absence of protein by neutralising with K_2CO_3, evaporating to dryness, incinerating at 400°, dissolving the ash in acetic acid, and applying the procedure used for blood-serum (A., 1931, 293). In the determination of Mg the preliminary treatment is the same but the incineration temp. is 500°. If the anion is Cl′ the ash is dissolved in acetic acid; if it is SO_4'', in HCl. The procedure of Fiske (A., 1921, ii, 411) is then applied.

W. McC.

Rapid determination of lime in presence of magnesium salts.—See B., 1940, 36.

Removal of iron with cupferron in colorimetric determination of lead with dithizone. (MME.) M. L. PANOUSE-PIGEAUD and H. CHEFTEL (Ann. Falsif., 1939, **32**, 296—301).—After wet combustion with H_2SO_4–HNO_3–$HClO_4$, Fe is pptd. in acid solution with cupferron (I), the complex is extracted with $CHCl_3$, and the excess of (I), which interferes with determination of Pb, is destroyed by heating the aq. residue to fuming. The usual method is then employed. E. C. B. S.

Determination of lead sulphate, considered from the viewpoint of the rule of residues and of substitution. N. A. TANANAEV and P. F. VERESCHNJA (J. Appl. Chem. Russ., 1939, **12**, 1229—1240).—A crit. survey of known methods is given. That depending on treatment with aq. Na_2CO_3, followed by titration with H_2SO_4, gives an error of 0·3—2%; the best results are obtained using 0·2N-Na_2CO_3. Treatment of $PbSO_4$ with aq. H_2S, followed by titration of the H_2SO_4 produced, involves an error $\not>$ 0·15%; this method is recommended. That depending on argentometric titration of the PbS ppt. is less satisfactory. Methods depending on conversion of $PbSO_4$ into $Pb_2Fe(CN)_6$ or PbC_2O_4 are unsatisfactory, owing to formation of 1 : 1, 2 : 1, 3 : 1, and 3 : 2 double salts of $Pb_2Fe(CN)_6$ and $PbSO_4$, and of 3 : 1, 4 : 1, and 6 : 1 double salts of PbC_2O_4 and $PbSO_4$. R. T.

Analysis of litharge and red lead.—See B., 1940, 63.

Quinaldinic acid as reagent for separation and determination of copper and cadmium. A. K. MAJUMDAR (Analyst, 1939, **64**, 874—876).—The method of Rây and Bose (cf. A., 1935, 1094) is studied with reference to the p_H of the solution when pptn. of Cu with quinaldinic acid takes place. Cu is completely pptd. at p_H between 2·01 and 1·22. After separation of the Cu, Cd is quantitatively determined in the filtrate by Rây and Bose's method, if the p_H of the solution is 2·15—2·01. Cu quinaldinate is appreciably sol. in AcOH. E. C. B. S.

Determination of aluminium with 8-hydroxyquinoline in presence of iron and of phosphoric acid. G. BĂLĂNESCU and M. D. MOTZOC (Z. anal. Chem., 1939, **118**, 18—26).—Data showing that the separation of Al from Fe by means of NaOH is not complete are recorded. The vals. for Al are always low, and the % error increases as the ratio Fe : Al increases. Repeated pptns. are necessary to remove the $Al^{\cdots}$ retained by the Fe_2O_3,nH_2O. The separation becomes quant. for all amounts of Al when the solution contains PO_4''' in an amount required to give a ratio Fe : $P_2O_5 \sim 2$: 1 by wt. For the determination of Al in presence of Fe, the Fe and P_2O_5 contents are found in aliquot portions of the solution by the usual methods, and then in another portion the $[P_2O_5]$ is adjusted to the above ratio by adding standard aq. Na_2HPO_4. The Fe is pptd. by adding conc. NaOH until an excess of 5 c.c. of N-NaOH is present. The solution is slowly heated to boiling, filtered, and the ppt. washed with boiling 0·05N-NaOH. The filtrate is neutralised (phenolphthalein) with 3N-HCl, and the Al pptd. at 50—60° by a 3% solution of 8-hydroxyquinoline in EtOH, and determined volumetrically by means of 0·1N-$KBrO_3$ (KBr). The method is applicable to soil extracts. L. S. T.

Precipitation of ferric hydroxide in presence of certain simple and complex ions. R. N. GOLOVATI, P. I. ILJENKO, and D. E. TORSKI (J. Appl. Chem. Russ., 1939, **12**, 1241—1249).—The solution

is conc. to small vol., 2 g. of NH_4Cl or NH_4NO_3 are added, and $Fe(OH)_3$ is pptd. from the boiling solution with conc. aq. NH_3; the ppt. is washed with hot dil. NH_4Cl or NH_4NO_3. In presence of complex-forming ions (Co, Ni, Cu, Zn, Cd) the solution is made acid with HNO_3, conc. to small vol., NH_4Cl or NH_4NO_3 is added, $Fe(OH)_3$ is pptd. from the boiling solution with aq. NH_3 saturated with NH_4Cl or NH_4NO_3, boiling is continued for 1 min., aq. NH_3 is again added, and the solution is filtered hot. The ppt. is washed as above. R. T.

Reduction by amalgamated zinc. Significant factors in efficiency. H. W. STONE and D. N. HUME (Ind. Eng. Chem. [Anal.], 1939, **11**, 598—602; cf. A., 1936, 953).—The rate of reaction between an oxidising agent and Zn amalgam depends principally on the nature of the former, and the [Zn] on the surface of the amalgam. Reduction of 0·2N-$Fe_2(SO_4)_3$, $Ce(SO_4)_2$, and $KMnO_4$ (0·2N. with respect to $H^{\cdot}$) is quant., and the amalgam showed no deterioration with use. Reduction of oxidising agents such as $V_2O_2(SO_4)_2$, the green and violet forms of Cr^{III} salts, etc. which are not reduced by Hg shows wide variations, and diminished after the amalgam had been in use owing to depletion of Zn at the surface. Curves showing the reaction rates of these compounds with Zn amalgams are reproduced. Contrary to published statements, freshly-prepared solutions of green Cr^{III} chloride (I) (the dichlorotetra-aquo-complex) made from the dry salt are rapidly and completely reduced, with or without the addition of acid. The absence of depletion effects during the reduction of (I) and $V_2O_2(SO_4)_2$ is due to the formation of a liquid amalgam surface through which diffusion of fresh Zn is rapid enough to replace the Zn lost by oxidation. Curves showing comparative reaction rates of chrome alum solutions by amalgams containing different amounts of Hg are reproduced. The most suitable amount of deposited Hg ranges from 0·1—1% with oxidising agents not reduced by Hg and with acid concns. $\ngtr$ 0·2N., to 5% for oxidising agents reduced by Hg and Zn, and especially with higher concns. of acid. L. S. T.

Colorimetric determination of iron in aluminium etc.—See B., 1940, 47.

Gravimetric determination of antimony by means of 8-hydroxyquinoline. T. I. PIRTEA (Z. anal. Chem., 1939, **118**, 26—30).—Pptn. of $Sb^{\cdots}$ as yellow $Sb(C_9H_6ON)_3$ from chloride solutions occurs between p_H 1·5 and 7, and is quant. in slightly acid (p_H 6) or slightly ammoniacal solutions; 0·000012 g. of Sb in a total vol. of 5 c.c. can be detected. To determine Sb an excess of an AcOH solution of 8-hydroxyquinoline (I) is added to the solution containing $Sb^{\cdots}$ and free HCl, and after warming to 60—70°, 10% aq. NH_3 is added until pptn. is seen to be complete, and there is no odour of AcOH. The solution is warmed for 1 min. more, and allowed to cool for 1—2 hr. The ppt. is collected on a Jena glass filter (1 G3 or 1 G4), washed with a cold solution containing 0·2—0·4 g. of (I) and several drops of AcOH per l., and dried at 105—110°. The ppt. is slightly sol. in warm, distilled H_2O. It loses wt. slowly at 120°, and at higher temp. is decomposed to metal (+ oxide). From aq., HCl, or tartaric acid solutions of tartar emetic, Sb is quantitatively pptd. as $SbO(C_9H_7ON)_2,C_9H_6ON$ by the above procedure. Alkali antimonate solutions are acidified with HCl before determining the Sb as above. Test data are recorded. L. S. T.

Realisation of the international scale of temperature between 0° and 660°. J. ROLINSKI and Z. GAJEWSKI (Acta Phys. Polon., 1939, **7**, 305—309).—Pt resistance thermometers have been calibrated in accordance with the requirements of the VIII General Conference of Weights and Measures (Paris, 1933, 94) at 0°, 100°, and 444·6°, and have been checked at the temp. of solidification of Sb (630·5°). O. D. S.

Constant-temperature apparatus. R. TIOLLAIS and A. PÉDRON (Ann. Chim. Analyt., 1939, [iii], **21**, 285—289).—The apparatus described and illustrated is a modification of that described previously (Bull. Soc. chim., 1936, [v], **3**, 1509). Temp. between 20° and 120° can be maintained to ±0·01° without special thermal insulation, and in spite of variations in circuit voltage. The reaction vessel is enclosed by a bath of Hg, which is heated electrically. The changes in vol. of the Hg control the heating current. L. S. T.

Resolving power of supermicroscope. B. VON BORRIES and E. RUSKA (Z. tech. Physik, 1939, **20**, 225—235).—Factors limiting the resolving power of the electron and magnetic supermicroscope are discussed. A resolving power of 5 mμ. can be reached with the magnetic supermicroscope. A. J. M.

Electron supermicroscope at Toronto. E. F. BURTON, J. HILLIER, and A. PREBUS (Physical Rev., 1939, [ii], **56**, 1171—1172; cf. Prebus, A., 1939, I, 433).—A report on the development and refinement of the instrument. The resolving limit is >60 A. N. M. B.

Single-crystal fluorescent screen and supermicroscopy. M. VON ARDENNE (Z. tech. Physik, 1939, **20**, 235—239).—The use of single-crystal fluorescent screens of activated ZnS in supermicroscopy is described. They give a resolving power of 5 mμ. for ultra-violet light and 10 mμ. for electrons. A. J. M.

Hydrogen arc for absorption spectroscopy. A. J. ALLEN and R. G. FRANKLIN (J. Opt. Soc. Amer., 1939, **29**, 453—455).—A H_2 arc operating at 40 v. is described. L. J. J.

Four-filter photo-electric colorimeter. B. T. BARNES (J. Opt. Soc. Amer., 1939, **29**, 448—452).—Tests are described. L. J. J.

Spectrocolorimeter for comparing the spectra of solutions of different depth. E. PERLMAN (Science, 1939, **90**, 279—280).—A hand spectroscope is mounted immediately above the prisms of a colorimeter of the Duboscq type. Specimens, such as urine- or bile-stained blood, that have an interfering colour can thus be more accurately compared. L. S. T.

Apparatus for isolating monochromatic light of high intensity at 254 mμ. L. J. HEIDT (Science, 1939, **90**, 473—474). L. S. T.

Use of the nephelometer for serial determinations of small quantities of arsenic by Bougault's method. J. THURET (Ann. Falsif., 1939, **32**, 328—330).—The prep. of a stable standard by heating colophony with aq. borax and its use in the Pulfrich photometer are described. E. C. B. S.

Means of measuring turbidity and fluorescence using the Lovibond Tintometer fitted with Rothamsted device. G. S. FAWCETT and J. HEWITT (J.S.C.I., 1939, **58**, 342—344).—An easy method is described for measuring turbidities and fluorescence, using a special cell designed for use in the Lovibond–Schofield Tintometer. Comparison is made of results using the special cell with those obtained with a standard cell, and it is shown that the special cell gives accurate readings between 0 and 10 parts of fuller's earth per 100,000, a range not covered accurately by the standard cell.

Tube illuminator for metallography. L. L. WYMAN (Met. Progr., 1939, **36**, 262—263).—An evacuated tube formed into a spiral cylinder which fits around the objective and sample produces a spherical wall of light reaching every place within the field of the objective. R. B. C.

Radiation properties of different substances within the temperature range 250—800°. M. PIRANI (J. Sci. Instr., 1939, **16**, 372—378).—A method is developed for comparing the total radiations from samples at high temp. in which the heated sample is placed opposite a fixed thermopile, screened by diaphragms so that the radiation is mainly perpendicular to the surface. The sample is always made of the same size as the fused SiO_2 plate used as standard. The emission of SiO_2 is calc. from measurements of its transmission for various λλ in the infra-red region at room temp., and from the results the relative emissivities perpendicular to the surface at 300—800° have been calc. for several materials relative to a black body. J. W. S.

Polarimetric researches in the Schumann ultra-violet. R. SERVANT (Ann. Physique, 1939, [xi], **12**, 397—479; cf. A., 1938, I, 498; 1939, I, 514).—Details of the apparatus and methods used in obtaining the data previously recorded are given. Obliquely banded spectra are produced in an evacuated system by an arrangement of a concave grating and mirrors. A condensed discharge between W electrodes is used as light source. L. J. J.

Changes in internal resistance of selenium barrier-layer cells caused by exposure to light. A. E. SANDSTRÖM (Phil. Mag., 1939, [vii], **28**, 642—648; cf. A., 1939, I, 9).—Changes in the resistance of cells of the Falkenthal type are caused by exposure to light or *X*-rays. On exposure, the resistance decreases by $\sim 20\%$ and then slowly increases on storage in the dark. The changes are located in the barrier layer, and are a possible source of error when such cells are used for measuring intensities. F. J. G.

Condenser for the testing of liquid dielectrics. L. HARTSHORN and E. RUSHTON (J. Sci. Instr., 1939, **16**, 366—368).—The condenser comprises two co-axial cylindrical brass tubes, Pt- or Rd-plated, and insulated by a single collar of fused SiO_2. The outer electrode also serves as a container which can be evacuated, filled with dry air or with a liquid, for dielectric const. and power factor measurements. The advantages claimed include rigidity, ease of cleaning, small. vol. of liquid required (15 ml.), high insulation resistance, and very low residual inductance and power factor. The apparatus is suitable for measurements at $\not> 20$ megacycles per sec. J. W. S.

Apparatus for electrodialysis and separation of organic colloids into sols and gels. O. DAHL (Svensk Kem. Tidskr., 1939, **51**, 219—225).—The apparatus allows simultaneous dialysis and electrophoretic fractionation into sol and gel components. F. J. G.

Detonation. LIBESSART [with CULMANN and PENCIOLELLI]. (Chim. et Ind., 1939, **42**, 774—778).—The arrangement previously described (Recherches et Inventions, 1936), which produces a spark of duration $<10^{-7}$ sec., has been used to record explosion phenomena. A time scale is furnished by the flight of a bullet. F. J. G.

Electromagnetic separator for mineral powders. R. C. EVANS (Min. Mag., 1939, **25**, 474—478).—The apparatus is essentially the same as that first designed by Hallimond (A., 1930, 1395) with some modifications. L. J. S.

Comparing resistances of four-terminal resistors. J. J. DOWLING (Nature, 1939, **144**, 865—866). A method of comparing resistances of $\sim 0{\cdot}001$ ohm with an accuracy of 1 in 10^3 is described. The method can also be applied to thermo-couple measurements. L. S. T.

Electrostatic generator and ion source for high-voltage research. I. A. GETTING, J. B. FISK, and H. G. VOGT (Physical Rev., 1939, [ii], **56**, 1098—1104).—The construction and performance of a Van de Graaff-type generator, incorporating new features, are described. N. M. B.

Technique of the measurement of secondary emission of electrons. W. MAJEWSKI (Acta Phys. Polon., 1939, **7**, 327—339).—Two types of valve suitable for the study of secondary electron emission are described. O. D. S.

Cause of multiple discharges in a Geiger–Müller counter. C. H. COLLIE and F. MORGAN (J. Sci. Instr., 1939, **16**, 369—372).—Double kicks in a Geiger–Müller counter can be produced by the presence of small amounts of xylene vapour in the counter. The effect is due to the release of an electron from the cathode when the xylene ions are discharged, this occurring 10^{-3} sec. after the first discharge. J. W. S.

Substitute for laboratory oil baths. A. A. MORTON (Ind. Eng. Chem. [Anal.], 1939, **11**, 592).—Al pots, 1·3 cm. thick, of different sizes to provide ~ 3 mm. clearance between the walls and the enclosed distillation flasks, have many advantages over oil baths. L. S. T.

Construction of manometers for measuring flow. A. D. LORING (Ind. Eng. Chem. [Anal.], 1939,

11, 626—628).—Direct-reading flow manometer gauges with vertical and inclined scales, a manometer for measuring the flow of cooling H_2O, and U-tubes for measuring the performance of four fans operating in parallel, are described. L. S. T.

Pressure regulator for dynamic gaseous systems. J. H. BRUUN (Ind. Eng. Chem. [Anal.], 1939, **11**, 628).—The device described is used for maintaining pressures > atm., and for calibrating flowmeters at similar pressures. L. S. T.

Semimicro-Kjeldahl distillation apparatus. C. E. REDEMANN (Ind. Eng. Chem. [Anal.], 1939, **11**, 635—636).—Details of construction and operation of an apparatus in which the NH_3 is not liberated until air is expelled, the acid in the receiving flask does not suck back, and one flask is used for digestion and steam distillation, are given. Test data for $(NH_4)_2SO_4$ show that liberation of NH_3 is complete in <6 min., and that samples containing 0·6 mg. of N can be used. L. S. T.

Constant-level still for re-distillation of water. D. A. WILSON and H. S. STRICKLER (Ind. Eng. Chem. [Anal.], 1939, **11**, 636). L. S. T.

Apparatus for study of pressure–volume–temperature relations of liquids and gases. B. H. SAGE and W. N. LACEY (Amer. Inst. Min. Met. Eng., 1939, Tech. Publ. 1127, 22 pp.; Petrol. Tech., 1939, **2**, No. 4).—The material is introduced into a chamber which can be kept at 70—600° F. under pressures, applied through a pressure balance, up to 10,000 lb. per sq. in. Full details of construction and operation are given. A. R. PE.

Measurement of the velocity of propagation of explosions [in gases]. R. ZOUCKERMANN and L. HEYBERGER (Compt. rend., 1939, **209**, 680—682).—In the apparatus described the flame front passes down a tube (diameter d) over a succession of bolometers, the disturbances of which are recorded by an oscillograph; the intervals are read from a superimposed time-base. Data for H_2–O_2 mixtures saturated with H_2O show that the min. H_2 content required for flame propagation is independent of d; the velocity of propagation increases with the H_2 content and d. A. J. E. W.

Rocking device for Carrel flasks. H. SHAPIRO (Science, 1939, **90**, 308). L. S. T.

Micro-immersion filter. (MISS) C. C. MILLER (J.C.S., 1939, 1962).—Directions are given for making a glass micro-filter which employs a filter disc 3·5 mm. diameter and 1·5 mm. thick, and for which a large filtering surface and the need for only small quantities of washing liquid are claimed. C. R. H.

[Apparatus for the] periodic discharging of liquids and intermittent washing of solids. C. L. GRAHAM and R. H. LAMBERT (Science, 1939, **90**, 280). L. S. T.

Geochemistry.

Ozone in the Sept. 21st, 1938, hurricane. C. A. PETERS (Science, 1939, **90**, 491).—The odour of O_3 was strong during the latter part of the storm. L. S. T.

Analysis of sulphurated water of Carobbio (Parma). G. ILLARI and M. ZUCCHETTI (Annali Chim. Appl., 1939, **29**, 467—474).—Chemical and physico-chemical data for the H_2O (which contains 0·0080 g. of HS′ per l.) are tabulated and discussed. F. O. H.

Mechanism of dolomitisation of calcareous sediments. A. RIVIÈRE (Compt. rend., 1939, **209**, 691—692; cf. A., 1940, I, 46).—The observed loss of Mg from sea-H_2O in contact with $CaCO_3$ is $\gg$ the loss deduced from the fall in reserve alkalinity, owing to replacement of the Mg by a slow exchange process at the surface of the $CaCO_3$. The exchange is retarded by a fall in p_H. The results are discussed with reference to dolomitisation of sediments under various natural conditions. A. J. E. W.

Radioactivity of potassium as a means of estimating its relative age in meteorites. H. SUESS (Naturwiss., 1939, **27**, 702—704).—The radioactivity of ^{40}K in 7 meteorites has been measured, and compared with that of naturally occurring K by means of a Geiger–Müller counter. From the difference, the age of K in meteorites can be computed from the half life of ^{40}K. Theories of the origin of K in meteorites, and of meteorites themselves, are discussed. W. R. A.

Santa Luzia de Goyaz meteorite. V. B. MEEN (Amer. Min., 1939, **24**, 598—601).—Chemical analyses of the contained kamacite (I) and of the (I) + taenite mass are recorded. Troilite, schreibersite, and traces of plessite are also present. L. S. T.

Association of harmotome and barium felspar at Glen Riddle, Pennsylvania. A. E. MEIER (Amer. Min., 1939, **24**, 540—560).—The occurrence of the Ba zeolite, harmotome (I), in a gabbroic dyke at Glen Riddle, Pa., in close association with Ba felspar (hyalophane) and corundum is described. Photomicrographs of (I) and important rock types in the dyke are reproduced. The paragenesis of the Ba minerals is described and discussed. (I) has α 1·506, β 1·509, γ 1·514, ρ 2·47, hardness 4·5, SiO_2 45·51, Al_2O_3 16·50, MgO 0·27, Ca 0·12, BaO 19·89, K_2O 1·77, Na_2O 1·18, H_2O– 14·74, total 99·98%. The changes in optical properties that accompany the loss of H_2O on heating are tabulated. L. S. T.

Petrography of the Permian rocks in the southern part of the Vale of Eden. H. C. VERSEY (Quart. J. Geol. Soc., 1939, **95**, 275—298).—The heavy minerals, zircon, tourmaline, garnet, rutile, etc., and their frequency of occurrence are described. The source of the sediments, and the nature of the coloration of the red beds, are discussed. L. S. T.

Alteration of glasses to montmorillonite. E. A. HAUSER and H. H. REYNOLDS (Amer. Min., 1939, **24**, 590—597).—Montmorillonite (I) is formed

by heating for ≯ 150 hr. a synthetic glass of the same composition as (I) under pressure at 300° in presence of H_2O, aq. H_2SO_4, NaOH, KOH, $Ca(OH)_2$, or $Mg(OH)_2$. The products were of the non-swelling type of (I), and ranged in colour from white to grey to brown. Those formed in presence of H_2SO_4 showed a high adsorptive capacity towards methylene-blue. Extreme comminution of the glass, or heating for 290 hr., completely changed the (I) to a different product. Obsidian is more stable than the glass, and yielded fuller's earth only after heating for 15 days. The geological significance of these results on the formation of bentonite is discussed, and the possible manufacture of synthetic clays by this method is pointed out. L. S. T.

Symmetry of phosphosiderite. D. McConnell (Amer. Min., 1939, **24**, 636—642).—Phosphosiderite from Pleystein, Bavaria, is monoclinic, and has a_0 5·30, b_0 9·79, c_0 8·67 A. (all ±0·01 A.), and β 89° 24′ (goniometer); space-group C_{2h}^1, or probably C_{2h}^2. The unit cell contains 4 mols. of $FePO_4,2H_2O$, giving $\rho_{calc.}$ 2·74. L. S. T.

Microcline in the native copper deposits of Michigan. I. Klein (Amer. Min., 1939, **24**, 643—650).—The " red felspar " abundant in several of the ore bodies is an unusual variety of microcline of low- or moderate-temp. hydrothermal origin, characterised by an adularia-like habit and a low Na_2O content (K_2O 14·98, Na_2O 0·17%). Finely-divided hæmatite is responsible for the bright brick-red colour. L. S. T.

Modes of quartz-bearing plutonites from Derby, Vermont. J. E. Maynard (Amer. Min., 1939, **24**, 653—656).—Mineral analyses for 10 rocks are tabulated and discussed. L. S. T.

Petrographic study of the Niagaran rocks of S.W. Ohio and S.E. Indiana. R. R. Priddy (J. Geol., 1939, **47**, 489—502).—The minerals are chiefly authigenic, but small amounts of detrital minerals are present. The Euphemia, Springfield, and Cedarville dolomites are true dolomites, but the Dayton and Laurel limestones are dolomitic (78·06—87·19% of dolomite). L. S. T.

Differentiation in xenolithic lamprophyre dykes at Marquette, Michigan. V. L. Ayres and W. D. Higgins (J. Geol., 1939, **47**, 561—582).—Petrological. A chemical analysis [L. Gardiner] of the spessartite, which forms the greatest part of the dykes exposed, is recorded. L. S. T.

Silurian sea balls. C. Croneis and D. M. Grubbs (J. Geol., 1939, **47**, 598—612).—Siliceous nodules are common in the " Niagaran " dolomite near Chicago. One type consists of an intimate mixture of silicified fossils in a matrix of $CaCO_3$. The mode of origin is compared with that of the " sea balls " and " lake balls " produced by wave action in shallow waters. L. S. T.

Statistical methods in sedimentary petrology. I. Percentage composition of [heavy mineral] assemblages and their graphical study. II. Grain-size measurements and their graphical study. III. Cartographic methods. F. Smithson (Geol. Mag., 1939, **76**, 297—309, 348—360, 417—427).—I. Variations due to sorting processes and to mineralogical changes are treated mathematically for Triassic and Jurassic sediments in Yorkshire.

II. Micrometric methods applicable to the minerals of sedimentary rocks, and the use of their graphical study for the elucidation of problems in sedimentary petrology, are discussed.

III. Methods by which the data of sedimentary petrology (mineralogical composition, particle size, etc.) can be the most usefully recorded on a map are discussed and illustrated. L. S. T.

Selective staining [of minerals] to facilitate Rosiwal analysis. M. L. Keith (Amer. Min., 1939, **24**, 561—565).—In the technique described, the rock section is treated with conc. HCl and malachite-green to gelatinise and colour nepheline-bearing rocks, and then with HF vapour and $Na_3Co(NO_2)_6$ to stain K felspars. Other minerals may be affected by the procedure. After staining, the time required for a Rosiwal analysis with an electric counter is reduced to 35 min. L. S. T.

Formula and structure of ralstonite. A. Pabst (Amer. Min., 1939, **24**, 566—576).—Powder, Laue, and rotation X-ray data for ralstonite from Ivigtut, Greenland, are recorded. The lattice const. is 9·87 A., the cell vol., 961·5 A.^{3}, and the probable space-group O_h^7—$Fd3m$. Structure is discussed, and interat. distances are calc. After heating to const. wt. at 450° the crystals are only whitened, and structure is largely maintained. The total loss at 450° is ~30%, H_2O and HF being driven off. Heating for 3 hr. at 650° produces no further loss in wt., and the crystals remain outwardly perfect. L. S. T.

Random structures of layer minerals as illustrated by cronstedite, $2FeO,Fe_2O_3,SiO_2,2H_2O$. Possible iron content of kaolin. S. B. Hendricks (Amer. Min., 1939, **24**, 529—539).—Cronstedite (I), a_0 5·48, b_0 9·49, c_0 21·25 A., β 90° (cf. A., 1936, 959), is formed of kaolin-like layers containing $Fe^{\cdots}$ with tetrahedral and octahedral co-ordination of surrounding O and OH ions. These layers are superimposed with a random mixing of 3 possible structures. Although (I) is related to kaolinite (II) in structure, it is improbable that the (II) lattice will accommodate appreciable amounts of Fe in solid solution. X-Ray examination and differential heating curves show that faratsihite is a mixture of nontronite and an ordinary kaolin mineral. L. S. T.

Influence of strain on the arrangement of quartz and cristobalite crystallites in chalcedony, quartzine, and lussatite. F. Laves (Naturwiss., 1939, **27**, 705—707).—From X-ray and microscopical examination " blue chalcedony " (I) from Weitendorf has the same cryst. form as cristobalite, and is another form of chalcedony (II). (I) has a positive optical characteristic relative to the fibre direction, whereas (II) has a negative characteristic, due to the quartz c-axis being perpendicular to the fibre direction; (I) is named lussatite. During crystallisation, the c-axis evades the strain, and behaves similarly in quartz and cristobalite. Whilst the lussatite arrangement appears always as primary and the chalcedony secondary, the arrangements are similar. W. R. A.

Magnetite in sand at estuary of the [River] Simeto [Sicily]. B. TANTERI (Annali Chim. Appl., 1939, **29**, 474—479).—The sand contains 23—25% of Fe_3O_4. Analytical data for the magnetite are similar to those for magnetite from the lava of a neighbouring volcanic region (of Mt. Etna). F. O. H.

Tektites and silica-glass. L. J. SPENCER (Min. Mag., 1939, **25**, 425—440).—Of the 84 published chemical analyses of tektites only 34 give data for *d* and *n*, which were presumably determined on the same sample of material as that analysed. These are tabulated and the data plotted. Both *d* (2·498—2·339) and *n* (1·526—1·4867) show a nearly uniform decrease with increase in SiO_2 (60·00—80·73%). These are compared with the few available data for natural glasses (SiO_2 68·88—98·63%) from meteorite craters, which have been produced by the fusion of siliceous terrestrial materials when very large metallic meteorites have struck the earth's surface. Darwin glass (SiO_2 86·34—89·81%) from Tasmania (previously classed with the tektites and assumed to have fallen from the sky as meteorites) is a meteorite-crater glass. Further details are given of the silica-glass from the Sand Sea in the Libyan Desert, Egypt (A., 1934, 505), and a new analysis by M. H. HEY shows SiO_2 98·20%, etc. No mode of origin can be suggested for this material. Another form of silica-glass—fulgurites, as thin-walled tubes—found in the same region, has been produced by the fusion of the dune sand by lightning. L. J. S.

Twinnings and groupings of phenocrysts of felspar and of β-quartz. J. DRUGMAN (Bull. Soc. franç. Min., 1939, **62**, 99—132). L. S. T.

Determination of felspar twins. R. C. EMMONS and R. M. GATES (Amer. Min., 1939, **24**, 577—589). L. S. T.

Detection of porphyrin and other organic substances in calcite and aragonite. H. HABERLANDT (Naturwiss., 1939, **27**, 613—614).—Calcite from Deutsch-Altenburg and aragonite from Mödling have been treated with dil. HCl and the residues with org. solvents. Examination of the absorption and fluorescence spectra of both solutions indicates the presence of porphyrin, quinoline-type compounds, anthracene, and phenanthrene. W. R. A.

Datolite from the volcanic group of the Kara-dag in the Crimea. M. N. SCHKABARA and E. A. STURM (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 166—170).—The datolite of the Karagach range (I) is confined to the fractures of andesite rocks which it fills with transparent crystals 0·2 to 1 cm. diameter. Datolite is also encountered in the form of dull barrel-shaped crystals in association with calcite. The datolite of the andesite sopka (II) is violet, and well-developed crystals are rare. Analyses of specimens of (I) and (II) indicate $2SiO_2,2CaO,B_2O_3,H_2O$. The crystals have been subdivided into four groups according to combinations, and a crystallographic description of these is given. W. R. A.

Datolite from the Soganlug talus in the neighbourhood of the town of Tbilissi. G. V. GVACHARIA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 162—165).—Four types of crystals are present in datolite from the Soganlug talus which depend closely on the conditions of their formation. 28 forms have been established from goniometric measurements and the characteristics of each are recorded. The chemical composition of the datolite closely approaches the theoretical, and can be represented by $2CaO,B_2O_3,2SiO_2,H_2O$ or $CaB_2Si_2O_8,Ca(OH)_2$. W. R. A.

Petrographic studies of the region of Monte Besimauda (Maritime Alps). M. FORNASERI (R.C. Atti Accad. Lincei, 1939, [vi], **29**, 613—619).—Petrographic and chemical composition data are given. O. J. W.

Petrographic studies of Val Masino (Valtellina). I. Tonalitic diorite and vein-bearing granite of Bagni-Masino. L. PERETTI (R.C. Atti Accad. Lincei, 1939, [vi], **29**, 607—613).—Petrographic and chemical composition data are given. O. J. W.

Geological study of the Mandas sheet, 225° of the map of Italy, 1 : 100,000. A CAVINATO (R.C. Atti Accad. Lincei, 1939, [vi], **29**, 597—601).—The rocks and minerals in this region are described. O. J. W.

Differential thermal analysis of kaolinite. (MLLE.) S. CAILLÈRE and S. HÉNIN (Compt. rend., 1939, **209**, 684—686).—The evolution of heat observed at 1000° during differential thermal analysis of kaolinite (I) (cf. A., 1933, 1268) is greater for particles of diameter $>2\ \mu$., separated by a flocculation process, than for untreated (I). The heat effect is also increased to a successively greater extent by fixation of K, Ca, or Na by the (I), and reduced by fixation of Fe, the results depending also on the mode of fixation. The heat evolved decreases as the amount of fixed base is increased. A. J. E. W.

Polymorphism of Cu_2S and the relations between the solid phases in the system Cu_2S–CuS. N. W. BUERGER (J. Chem. Physics, 1939, **7**, 1067—1068).—*X*-Ray examination of the solid phases in the system Cu_2S–CuS shows that chalcocite undergoes three transformations, orthorhombic superstructure $\rightleftharpoons$ non-isometric ordered basic structure $\rightleftharpoons$ non-isometric partly disordered basic structure $\rightleftharpoons$ non-isometric completely disordered basic structure, occurring respectively at 52°, 78°, and 105°. A new compound, Cu_9S_5, having a powder pattern identical with that of digenite, is indicated. At $<47°$ digenite has the ideal composition Cu_9S_5 but at $>47°$ it takes up Cu_2S or CuS. Cu atoms in digenite are probably ordered at temp. $\leqslant 47°$. The heat effect at $\sim 91°$ is due to the transformation of ordered high chalcocite into the disordered high chalcocite. 8% of CuS prevents this change and causes the absence of a heat effect for such solutions. W. R. A.

Genesis and age of green Syrian rocks. L. DUBERTRET (Compt. rend., 1939, **209**, 763—764; cf. *ibid.*, 1937, **204**, 283, 1663). A. J. E. W.

Some red-coloured earths in the neighbourhood of Anghiari (Province of Arezzo). C. LIPPI-BONCAMBI (R.C. Atti Accad. Lincei, 1939, [vi], **29**, 491—498).—A geological description of various samples, with some analytical data. O. J. W.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

MARCH, 1940.

Fine structure of the hydrogen lines. J. STARK (Physikal. Z., 1939, **40**, 591—592).—The fine structure of the H lines is discussed from the viewpoint of the analogy between the H atom and the atoms of the alkali metals. The latter have a duplet spectrum in the visible, which is also found for H. As in the case of the alkali metals, each duplet component of the H lines itself consists of three components, one a line of the principal series, the other two subsidiary series lines. A. J. M.

Hydrogen showers in the auroral region. L. VEGARD (Nature, 1939, **144**, 1089—1090).—Spectrophotograms of the recent auroral display show marked enhancement of lines coinciding with H_α and H_β. Considerable quantities of H are thus occasionally present in the auroral region, and they must be due to showers of H or to a kind of H radiation coming from the sun. L. S. T.

Transition probabilities for He I. L. GOLDBERG (Astrophys. J., 1939, **90**, 414—428).—Simple, screening-type wave functions are utilised to derive general expressions for the line strengths in the $2s$—np and $2p$—nd series of He I. The strengths thus found agree satisfactorily, for transitions up to $n = 6$, with those computed by Hylleraas (A., 1937, I, 441). The He I triplet damping factors are $\sim$100 times $<$ the singlet vals. L. S. T.

Intensity measurements of helium lines in absorption. H. C. BURGER and H. P. VAN CITTERT (Physica, 1940, **7**, 13—16).—The absorption coeff. of He at pressure 1·5 mm. Hg excited by currents of 0·5—100 ma. in a tube 1 cm. radius has been measured for the lines $2'S$—$3'P$ and $2'S$—$4'P$. The absorption coeffs. increase more slowly than the exciting current, and that of the former line is $3{\cdot}4 \pm 0{\cdot}2$ times that of the latter, in agreement with Hylleraas' theory (A., 1937, I, 441). L. J. J.

Spin of ^{13}C. C. H. TOWNES and W. R. SMYTHE (Physical Rev., 1939, [ii] **56**, 1210—1213).—In view of the disagreement of the spin val. 3/2 on the α-particle model and the val. 1/2 on the Hartree model, ^{13}C was conc. in a Hertz diffusion system to an abundance of 50% and enough 35% ^{13}C was obtained for a measurement of nuclear spin from the relative intensities of the Λ-type doublets of two lines of the O–O Swan band of ^{13}C–^{13}C. An intensity analysis of the combined interference patterns of the two doublets proves that the ^{13}C nucleus obeys the Fermi–Dirac statistics and strongly indicates a spin of 3/2 (cf. Sachs, A., 1939, I, 352). N. M. B.

Shift of intensity in N_2^+ bands excited in helium and neon. T. TAKAMINE, T. SUGA, and Y. TANAKA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 437—448).—The spectroscopic study of N_2 at 0·2 mm. in the presence of He or Ne at 18 mm. shows a distinct shift in the intensity of the second negative band N_2^+ $\{B'(^2\Sigma_u)X'(^2\Sigma_g^+)\}$ according to whether He or Ne is used as the diluent gas. The intensity relations of He have been previously accounted for (A., 1934, 935) whilst for Ne a three-body encounter $Ne^+ + N_2 + N'_{2_D} \rightarrow Ne + N_2{}^+_{(v'=5,B')} + N_{4_S}$ is proposed. D. F. R.

Nitrogen afterglow. M. KAMIYAMA and T. SUGIURA (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 948—956).—No confirmation could be obtained of the appearance of Kaplan's "auroral afterglow" in the N_2 afterglow. The results of exciting HgI in the N_2 afterglow were in accordance with Okubo and Hamada's investigation (A., 1934, 1279). D. F. R.

Theoretical aspects of active nitrogen. C. R. DHODAPKAR (J. Univ. Bombay, 1939, **8**, Part 3, 116—122).—Of three possible mechanisms by which active N_2 may be produced (A., 1936, 810) the assumption that the energy-bearing mols. of N_2 in the $B^3\Pi$ state are formed as a result of the recombination of free atoms in either two-body or triple collisions is in best agreement with experiment. F. R. G.

Origin of the 4932 A. emission in the spectra of Novæ. A. B. WYSE (Nature, 1939, **144**, 1090).—The assignment of this emission to O III (A., 1939, I, 589) is criticised. L. S. T.

Ionic depression of series limits in one-electron spectra. D. R. INGLIS and E. TELLER (Astrophys. J., 1939, **90**, 439—448; cf. Mohler, A., 1940, I, 88).—The effect of ionisation of the surrounding atm. in broadening the high-series terms of the alkali spectra so that they form a continuum down to a quantum no., n, is discussed. Ion density is $\propto n^{-7\cdot5}$. The effect of the mobility of the electrons is investigated. L. S. T.

Quenching and vibrational energy transfer in the fluorescence spectrum of S_2. E. DURAND (J. Chem. Physics, 1940, **8**, 46—51).—The ultra-violet fluorescence of S_2, excited by the strong Mg spark lines 2928 and 2937 A. (which excite the rotational levels $K' = 37$ and 41 in the vibrational level $V' = 8$ of the first excited electronic state), exhibits a typical Wood resonance progression. Addition of a few mm. of a rare gas (He, Ne, A, Kr, Xe) changes the fluorescence, due to quenching and to the transfer of vibrational and rotational energy. The yields per collision for both $\simeq 1$, and both show the same dependence on the at. wt. of the gas added, with a

min. near A or Kr. Quenching occurs by the addition of $2h\nu$ of vibrational energy to S_2, followed by disruption due to predissociation. Comparisons are made with the results obtained by other methods based on mol. dissociation rates, recombination rates, and propagation of supersonic waves. W. R. A.

New identifications of Fe III in the spectra of early B stars. P. Swings, B. Edlén, and J. Grandjean (Astrophys. J., 1939, **90**, 378—386; A., 1939, I, 167).—The vac.-spark spectrum of Fe from 2000 A. through the visible region has been obtained, and is used to show that ~100 lines observed in the spectra of early B-type stars are due to Fe III. The ionisation potential of Fe III is 30·48 v. L. S. T.

Number of lines in a series as a function of electron pressure. F. L. Mohler (Astrophys. J., 1939, **90**, 429—438).—In an intense discharge the higher lines of a series merge into a continuous spectrum at a val. of the effective quantum no., n_m, which depends on the electron concn., N_e. The no. of lines in the D and F series of the Cs discharge has been determined for the conditions investigated previously (cf. A., 1939, I, 112). The max. quantum no. for the red component of the D series and for the F series is given by $\log N_e = 23{\cdot}06 - 7{\cdot}5 \log n_m$. This relation agrees with theoretical results for hydrogenic spectra, and is used to estimate electron pressures in stellar atm. L. S. T.

Zeeman effects in complex spectra at fields up to 100,000 gauss. G. R. Harrison and F. Bitter (Physical Rev., 1940, [ii], **57**, 15—20).—Using a new type of electromagnet and a special horizontal arc with electrodes of salts compressed in Ag powder, spectrograms in the range 2000—8000 A. with high resolution were obtained. Preliminary data for Ce II, Rh I, and Ru I are tabulated. N. M. B.

Interaction of atomic energy levels. T. S. Subbaraya, K. Seshadri, and N. A. N. Rao (Current Sci., 1939, **8**, 508—510).—The effect of mixing Zn and Hg on the spectra of the two has been investigated. Spectrograms were obtained with pure Zn and with a mixture of Zn and Hg which exhibited the same intensity for the visible Zn triplet, and the intensities of the other lines relative to these in the two spectrograms were compared. The intensities of the Zn lines 3072, 3036, and 3018 A. in both arc and discharge are $\ll$ that of the resonance line 3076 A. for both Zn and Zn–Hg samples. In the pure Zn discharge 3076 A. is weaker than 3345 and 3302 A., but in the mixture it is stronger. Other intensity relationships are also discussed. Tentative explanations of the change of intensities are given. W. R. A.

Intensity changes in bright chromospheric disturbances. R. S. Richardson (Astrophys. J., 1939, **90**, 368—377).—Intensities for 18 bright chromospheric disturbances are given. The vals. are a combination of the measured areas of the flocculi and eye-estimates of their individual brightness. L. S. T.

Townsend ionisation coefficients for Ni and Al cathodes in an atmosphere of hydrogen. D. H. Hale (Physical Rev., 1939, [ii], **56**, 1199—1202).—Vals. measured for the α and γ coeffs. are compared with results previously reported for a Pt surface in H_2 (cf. A., 1939, I, 348). Vals. of α/p plotted as a function of X/p (X = field strength; p = pressure) show a decreasing characteristic for the X/p range 900—1400, and γ–X/p curves show a characteristic photoemission peak at $X/p = 131$, with a gradual rise at higher vals. of X/p. Sparking potential curves calc. from the γ-vals. are compared with experimental curves. N. M. B.

Photo-electric effect in incandescent metals. V. Ricca and M. Della Corte (R. C. Atti Accad. Lincei, 1939, [vi], **29**, 685—691).—At 2400° K. radiation of λ >3600 A. produces a photo-electric effect on a W filament, in agreement with Fowler's theory. O. J. W.

Mechanism of secondary emission of electrons from composite surfaces. P. V. Timofeev (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 11—15).—The calculation by Morgulis (A., 1939, I, 291) of the energy loss of a secondary electron on movement in the intermediate layer of a Cs_2O emitter, due to interaction between it and electrons with low bond energy, based on impact ionisation, is erroneous. This energy loss is only slightly different from that of a secondary electron in motion in a metal, and the length of the free path should be approx. the same in both cases. The large secondary emission from composite surfaces is due to the extraction of electrons by positive charges formed on the surface of a complex emitter when bombarded by a beam of electrons. The magnitude of the secondary emission is mainly determined by the time of recombination of positive ions, and by the average no. of electrons extracted by unit charge per sec. These quantities are determined by the electrical conductivity of the intermediate layer. A. J. M.

Effect of space-charge in the magnetron. E. B. Moullin (Proc. Camb. Phil. Soc., 1940, **36**, 94—100).—Theoretical. The presence of space-charge cannot increase the chance of an electron reaching the anode when H exceeds the crit. val. L. J. J.

Ionisation measurements in gases at high pressures. E. Kara-Michailova and D. E. Lea (Proc. Camb. Phil. Soc., 1940, **36**, 101—126).—Vals. calc. for the proportion of ions escaping recombination after formation of clusters of secondary ionisation by fast electrons, as a function of gas pressure and collecting field, are in agreement with existing experimental data for the effect of these variables on ionisation current produced by γ-radiation. Errors involved in the application of Jaffé's recombination theory for columnar distribution of ionisation to ionisation by fast electrons, X-rays, or γ-rays are indicated. L. J. J.

Inner shell ionisation of atoms by electron impact. E. H. S. Burhop (with an appendix by H. S. W. Massey) (Proc. Camb. Phil. Soc., 1940, **36**, 43—52).—The ionisation cross-section of the K shells of Ni, Ag, and Hg, and the L shells of Ag and Hg, for electron energies up to 15 times the ionisation potential of the shell, have been calc. Vals. for the

K shell and for relative ionisation in *K* and *L* shells are in good agreement with experiment. L. J. J.

The electron in the radiation field. II. O. Scherzer (Ann. Physik, 1939, [v], **35**, 665—670; cf. A., 1939, I, 298).—Mathematical. O. D. S.

Mechanical analogy to the motion of electrons in gases. G. D. Yarnold (Phil. Mag., 1940, [vii], **29**, 47—51).—The velocity distribution of steel spheres projected across an inclined plane into which nails have been driven at random is analogous to that of a stream of electrons through a gas in a uniform electric field. Close agreement with the Maxwellian distribution for a given mean final velocity is found, particularly for velocities > the mean. L. J. J.

Multiple scattering of electrons. S. Goudsmit and J. L. Sanderson (Physical Rev., 1940, [ii], **57**, 24—29).—Mathematical. A treatment of multiple Rutherford scattering, the distribution being expressed as a series in Legendre polynomials and evaluated. The distribution depends sensitively on the deviation from the Rutherford law for small angle scattering due to screening by electrons. N. M. B.

Absorption of high-energy electrons. IV. M. M. Slawsky and H. R. Crane (Physical Rev., 1939, [ii], **56**, 1203—1210; cf. A., 1938, I, 291).—Measurements of angular distribution of scattered electrons indicate that, for Pb with electrons <9Me.v., results are so affected by multiple scattering within the absorber that they afford little check on the theory for energy loss, but for 9—13·5-Me.v. electrons the loss is small enough to allow a comparison of energy losses with theory. Measurements of multiple scattering of 0·9-Me.v. electrons in thin Al sheets showed that the most probable and the average angles of scattering were in good agreement with theory. N. M. B.

Energy losses of fast electrons. A. I. Alichanov and A. I. Alichanian (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 192—194).—The average losses of energy *E* suffered by electrons having $E = 2{\cdot}2$—$2{\cdot}55 \times 10^6$ e.v. on passing through sheets of Pb or Al of varying thickness are, after allowing for distortion produced by Compton electrons, in agreement with those calc. by the Bloch formula. Losses in *E* were determined by focussing the electrons in a uniform magnetic field and using a spectrograph of high resolving power. F. H.

High-velocity atomic beams. I. Amdur and H. Pearlman (J. Chem. Physics, 1940, **8**, 7—12).—A general method (described) for the production and intensity measurement of high-velocity at. beams has been applied to at. H beam production with energies equiv. to 200—800-v. electrons. With this apparatus the absorption due to scattering of fast H atoms in mol. H_2 at room temp. has been measured, and from this the collision cross-section of these atoms has been obtained. W. R. A.

Diffraction of protons of medium energy by vapour molecules. H. J. Yearian (J. Chem. Physics, 1940, **8**, 24—28).—In a stainless steel ion source an arc of 0·5—2·0 amp. is struck in H_2 and the ions are accelerated to 1·5—2·0 kv. Resolution of the beam (~20% $H^{\cdot}$, 50% $H_2^{\cdot}$, 20% $H_3^{\cdot}$, and 10% heavy ions) into its ionic constituents is effected by a magnetic field and the scattered beam is focussed by a concentric-cylinder lens on to a fluorescent screen which replaces the recording film. This beam of protons was caused to impinge on a stream of vapour at ~10^{-5} mm. pressure. Space-charge effects near the ion source proved a difficulty and neutralisation of the beam by the vapour occurred. Cross-sections for neutralisation and ionisation have been determined for H_2, air, CCl_4, and EtOH. The sensitivity of the film decreases with outgassing in a vac. but increases when treated with oil. Attempts were made to record diffraction patterns of CCl_4, C_6H_6, EtOH, CS_2, and As_4O_6 but many difficulties were encountered, *e.g.*, production and maintenance of a vac., the weakness of the proton beam, scattering due to neutralisation, scattering at slits. Precautions taken to minimise the effects are discussed. With suitable precautions diffraction patterns with CCl_4 were obtained and the data are in agreement with the data of electron diffraction (A., 1935, 153). Possible improvements in the method are discussed. W. R. A.

Properties of the samarium nucleus and its structural isomerism. W. Wefelmeier (Ann. Physik, 1939, [v], **36**, 373—380).—With certain assumptions, the anomalous distribution of the Sm isotope abundance may be explained in part as due to the unfavourable energy arrangement of the Sm nucleus, which also gives rise to α-activity, and in part on the grounds of structural isomerism as shown by the discontinuity of the isotope displacement. L. G. G.

Rhythm of alpha-particle emission of polonium. J. Brenet (J. Phys. Radium, 1939, [vii], **10**, 507—512).—The liberation of α-particles from Po has been studied as a function of time by three methods. The data show that the emission has a periodic rhythm. Two possible interpretations for the oscillation, and their relation to the disintegration const., are discussed. W. R. A.

Method of coincidences applied to determination of the efficiency of Geiger–Müller counters and to measurement of the specific ionisation of the β-radiation of 50 to 1000 ke.v. T. Graf (J. Phys. Radium, 1939, [vii], **10**, 513—518).—The efficiency of counters with respect to β-radiations of different energies has been determined using a magnetic spectrograph. Vals. deduced for the primary sp. ionisation of β-radiations in air agree with Bethe's theory (A., 1930, 972; 1932, 789). W. R. A.

Scattering of α-particles by nitrogen. G. Brubaker (Physical Rev., 1939, [ii], **56**, 1181—1183).—The scattering into four angular ranges of mean angles 53°, 66°, 88°, and 104° shows anomalies for energies as low as 3·5 Me.v. Curves for the ratio of observed to Coulombian scattering as a function of energy vary greatly in form with scattering angle and show several max. and min. N. M. B.

Determination of β–β coincidences. F. Norling (Naturwiss., 1939, **27**, 593).—The two main difficulties in the determination of β–β coincidences, viz., the possibility that electrons might, by scattering from one counter tube, enter another, and the pro-

duction of disturbing secondary electrons by branching, can be almost completely avoided by placing between the horizontal counter tubes a vertical screen the height of a counter tube. The β-prep. is attached to the edge of the screen. To obtain high intensity, thin-walled counter tubes are used at atm. pressure. The arrangement was tested with the β–β coincidences from Ra-*E* and ^{198}Au. ~10% of the secondary particles were coupled with the primary ones, and are emitted within 2×10^{-5} sec. after the β-emission. The corresponding γ-radiation does not, therefore, arise from a metastable state. A. J. M.

γ-Rays from beryllium and nitrogen bombarded with deuterons. H. R. Crane, J. Halpern, and N. L. Oleson (Physical Rev., 1940, [ii], **57**, 13—15).—Measurements on the Compton electrons ejected from a thin lamina of C showed lines, in the case of Be + D, at 3·45 and 1·0 Me.v., and for N + D at 8·2, 6·6, and 5·1 with slight indications at 4·1 and 2·5 Me.v. Possible correlations of the lines with the energies of the heavy particles emitted are discussed. N. M. B.

Fast neutron measurements with recoil counters. S. A. Korff (Physical Rev., 1939, [ii], **56**, 1241—1242; cf. A., 1939, I, 396).—An arrangement for counting only particles producing > a certain no. of ions and discriminating against pulses produced by β- or γ-rays is described. The counter has no plateau and the counting rate rises steadily with the voltage. Preliminary data on a balloon flight study of cosmic-ray neutrons are reported. N. M. B.

Scattering of photo-neutrons from deuterium by nuclei of atoms of heavy metals. T. Golo-borodko and A. Leipunski (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 7—8).—The scattering cross-sections of Ra-Th-*D* photo-neutrons with energies of ~210 kv. with nuclei of heavy atoms from Mn to Bi have been determined. The irregularities in the scattering cross-sections which were observed with the light elements (A., 1937, I, 211, 339) occur also with the heavier elements. A. J. M.

^{3}He as an agent in nuclear reactions. W. H. Barkas (Physical Rev., 1939, [ii], **56**, 1242—1243; cf. A., 1939, I, 297; Alvarez, *ibid.*, 590).—Various possible reactions of ^{3}He and high-energy $^3He^{++}$ from a cyclotron are discussed. N. M. B.

Angular distribution of the transmuted particles in some transformation processes of light nuclei. H. Neuert (Ann. Physik, 1939, [v], **36**, 437—461).—Experiments have been carried out to discover whether the abundance of transmuted particles emitted at a given angle, with normal incidence of positive rays, is connected with the energy of the colliding particles. The processes ^{6}Li (^{2}D; *p*) ^{7}Li, ^{2}D (^{2}D; *p*) ^{3}H, and ^{11}B (*p*; α) ^{8}Be were investigated with energies up to 300 kv. In the process ^{6}Li (D; *p*) ^{7}Li the abundance ratio for a very thin layer for an energy of 180—290 kv. is 1·9—2. In the case of the process D (D; *p*) ^{3}H there is unsymmetrical angular distribution at voltages <40 kv. The abundance ratio increases with potential to 2—2·1 at 280 kv. In the case of ^{11}B (*p*; α) ^{8}Be there is a strong resonance-like max. of the abundance ratio at 170 kv. The results are discussed. A. J. M.

β–γ-Coupling with $^{76}_{33}$As. N. K. Saha (Naturwiss., 1939, **27**, 786).—The β-spectrum of ^{76}As may be regarded as arising from the superposition of three elementary sepctra with the upper limits 0·8, 1·7, and 2·5 Me.v., respectively. These lead to two excited states of the $^{76}_{34}$Se nucleus above its ground state and a γ-quant of ~1·7 Me.v. coupled with the 0·8-Me.v. β-spectrum, and a soft γ-quant of ~0·8 Me.v. coupled with the 1·7-Me.v. β-spectrum. These conclusions agree with experiment. A. J. M.

Periods of radio-rhodium and radio-silver obtained by slow neutrons. J. B. Rajam, P. C. Capron, and M. de Hemptinne (Ann. Soc. Sci. Bruxelles, 1939, **59**, 403—417).—Application of the static calculus method to experimental data yields the following periods for Ra-Rh and Ra-Ag: long periods, 4·34±0·06 and 2·44±0·06 min., short periods, 44·6±0·8 and 24·17±0·5 sec., respectively. The vals. for Ra-Ag are in good agreement with those of Moussa and Laurent (cf. A., 1938, I, 428). W. R. A.

Metastable levels of the gadolinium nucleus. D. Alchazov, I. Gurevitsch, I. Kurtschatov, and V. Rukavischnikov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 111—113).—The emission of an intense soft radiation from Gd_2O_3 irradiated with thermal neutrons has been observed photographically and its absorption curve in Cellophane, Al, Sn, and Cu measured. It is deduced that the radiation consists of electrons of energy ~100 ke.v., and that the absorption of neutrons by one Gd isotope gives a metastable nucleus which decomposes by a process of internal conversion. O. D. S.

Peculiarities in artificially produced atom types from nuclear splitting of uranium and thorium. O. Hahn (Ann. Physik, 1939, [v], **36**, 368—372).—A discussion on the many reaction products from the nuclear fission of U and Th, and some of the uses to which they can be put. L. G. G.

Radiations from radioactive isotopes of the rare earths formed in uranium and thorium. (Mme.) I. Curie and T. San-Tsiang (J. Phys. Radium, 1939, [vii], **10**, 495—496).—The β-ray spectra of the radio-element of period 3·5 hr., extracted from U and Th irradiated by neutrons, are identical, indicating the identity of the products of rupture. They are similar also to that of La (A., 1938, I, 593; 1939, I, 174). The highest energy level is ≮3·6 Me.v. W. R. A.

Disruption of the uranium and thorium nuclei into lighter atoms. O. Hahn and F. Strassmann (Physikal. Z., 1939, **40**, 673—680).—A detailed survey of the breakdown products from U and Th nuclei irradiated with fast and slow neutrons. In general Th gives rise to fewer products than U, and is split only by fast neutrons. L. G. G.

Radioactive gases evolved in uranium fission. L. Wertenstein (Nature, 1939, **144**, 1045—1046).—U_2O_3, surrounded by paraffin, was bombarded with neutrons from a Rn + Be source, and the radioactive

gases evolved in the fission process were carried by $COMe_2$ vapour through two Geiger–Müller counters. Typical curves indicate bodies of periods ~30 sec. and 4 min., as well as others of much longer period, giving rise to a residual activity that is practically const. within the time of experiment. L. S. T.

Disintegration of uranium nuclei in the interior of thick photographic emulsions bombarded by neutrons. A. P. Shdanov and L. V. Missovski (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 9—10).—Photographic plates which have been treated with a U salt, and have then been bombarded with neutrons, show tracks additional to those due to α-particles from the U. The tracks are ascribed to disintegration of the U nuclei by neutrons. A. J. M.

Solar influences on cosmic-ray intensity at high elevations. S. A. Korff (J. Franklin Inst., 1940, **229**, 21—27).—The amount of diurnal variation of cosmic-ray intensity has been investigated by instrument-carrying balloon flights to a height of 80,800 ft. The effect is < the experimental error (2%) but the night-time intensity may be ~1·5% < that during the day. The observations set an upper limit to the solar contribution to the ionisation at the height used due to photons in that spectral region in which the mass absorption laws are valid. The magnitude of the effect agrees with the theory of Vallarta that a magnetic field on the sun would produce a variation of 1—2% between day and night intensities in the softest portion of cosmic rays. A. J. M.

Behaviour of cosmic rays on passage through very thick layers of lead. I. Matthes (Ann. Physik, 1939, [v], **36**, 413—436).—The effect of a thick layer of Pb on cosmic rays has been determined with a triple and quadruple coincidence system. When 90 cm. of Pb are placed between the upper and lower counters, the no. of triple coincidences was 76%, and of quadruple coincidences 69%, of the no. of double coincidences. 37% of the hardest constituent of cosmic rays which penetrate 90 cm. of Pb consists of protons and neutrons, and 36% of this mixture is protons. This 37% is concerned with shower production. With the vertical arrangement of counters a larger proportion of coincidences can be traced to showers. The angle between the individual rays of showers is very small, and they are exceedingly penetrating. A. J. M.

Baade and Zwicky's theory of cosmic rays, and the helium content of beryls. J. Read (Nature, 1939, **144**, 1046; cf. A., 1938, I, 339).—If this theory is true, then the experimental evidence concerning the He content of beryls is not incompatible with the assumption that this He has been produced from Be by cosmic rays. L. S. T.

Simultaneous penetrating particles in cosmic radiation. G. Wataghin, M. D. de S. Santos, and P. A. Pompeia (Physical Rev., 1940, [ii], **57**, 61).—Experiments with a fourfold coincidence set indicate the existence of showers of two or more simultaneous penetrating particles probably associated with the penetrating cores of extensive showers. N. M. B.

Decay of penetrating cosmic rays. III. E. M. Bruins (Proc. K. Akad. Wetensch. Amsterdam, 1940, **43**, 75—80; cf. A., 1940, I, 54).—Theoretical. L. J. J.

Explosion showers. G. Wataghin (Physical Rev., 1939, [ii], **56**, 1245).—Mathematical. N. M. B.

Absorption of mesotrons in air and in condensed materials. E. Fermi (Physical Rev., 1939, [ii], **56**, 1242).—Mathematical. The larger absorption of mesotrons in air than in equal masses of condensed materials has been interpreted as evidence of spontaneous decay of the mesotron. An alternative explanation, not assuming mesotron decay, and based on the effect of the field of the passing particle on the electric polarisation of the substance, is examined. N. M. B.

Instability of the mesotron. G. Cocconi (Physical Rev., 1940, [ii], **57**, 61—62).—Clay's results (cf. A., 1939, I, 446) are confirmed, and indicate that the absence of absorption of cosmic rays at 60° to the zenith in Pb up to 30 cm. thick is due to the elimination in a slanting direction of the mesotrons of smaller energy. This view is supported mathematically. N. M. B.

Secondary mesotrons. V. Veksler and N. Dobrotin (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 103—105; cf. A., 1938, I, 490).—The possible error due to the effect of fast electrons on the proportional counters used in previous experiments is > was supposed. Results are not thereby invalidated and have been confirmed with a new arrangement of counters. O. D. S.

Atmospheric cosmic-ray absorption and mesons. W. Kolhörster and I. Matthes (Physikal. Z., 1939, **40**, 617—619).—The difference between the absorption curves for cosmic rays determined directly from balloon observations and indirectly by extrapolation from experimental curves of absorption in ice and H_2O can be interpreted as due to the importance of meson decomp. for the atm. curves. The decomp. path L is calc. on this hypothesis as $5·75 \pm 0·19$ km., agreeing within probable error with that calc. from the air pressure effect (A., 1939, I, 174). O. D. S.

Evidence for occurrence of meson pairs. H. J. J. Braddick and G. S. Hensby (Nature, 1939, **144**, 1012—1013).—Cloud-chamber photographs of cosmic-ray particles taken under 30 m. of London clay usually show the presence of mesons and often that of electronic showers. Five out of 2300 photographs show evidence of the simultaneous passage of two penetrating particles, which are interpreted as meson pairs. L. S. T.

Azimuthal dependence of processes involving mesons. T. S. Chang (Proc. Camb. Phil. Soc., 1940, **36**, 34—42).—Theoretical. L. J. J.

Scattering of mesons and the magnetic moments of proton and neutron. W. Heitler (Nature, 1940, **145**, 29—30).—Difficulties such as the diverging magnetic moment of the proton and the large scattering cross-section for mesons can be overcome by assuming that higher proton states with

charges $2e$ and $-e$, and those with a spin of 3/2, exist with a rest mass 25—50 electron masses > that of the proton. The cross-section for the scattering of mesons is then of the right order of magnitude, and the anomalous magnetic moments diverge only logarithmically. L. S. T.

Instability of the meson. M. A. POMERANTZ (Physical Rev., 1940, [ii], **57**, 3—12; cf. A., 1939, I, 175).—From comparative measurements of the intensities of mesons under air and under Pb, the average proper lives of mesons having energies on reaching the apparatus $>6\cdot1 \times 10^8$, $>11\cdot9 \times 10^8$, and $\sim9 \times 10^8$ e.v. are $3\cdot9\pm0\cdot3$, $3\cdot8\pm0\cdot4$, and $2\cdot6\pm0\cdot8$ μ-sec. The val. calc. by the Euler–Heisenberg theory from measurements of the no. of disintegration electrons and their secondaries in equilibrium with the mesons in air is ~6 μ-sec. N. M. B.

Transition probabilities in double β-disintegration. W. H. FURRY (Physical Rev., 1939, [ii], **56**, 1184—1193; cf. A., 1938, I, 430).—Mathematical. For double β-disintegration there is a marked difference in results of Majorana's symmetrical theory of the neutrino and of the Dirac–Fermi theory, and the transition probability in the former is much larger. Approx. vals. of this probability are calc. on the Majorana theory for the various Fermi and Konopinski–Uhlenbeck expressions for the interaction energy, and selection rules are derived. N. M. B.

Phase shift calculations for proton–proton scattering at high energies. H. M. THAXTON and L. E. HOISINGTON (Physical Rev., 1939, [ii], **56**, 1194—1198; cf. A., 1939, I, 395).—The theoretical *s* wave shift for the square well and the Gauss error well which is fitted to experiment from 0·7 to 2·6 Me.v. is calc. up to energies of 10 Me.v. The necessary coulomb functions are tabulated, and the phase shift and ratio of theoretical to Mott-formula scattering is plotted as a function of energy. The error well and square well give very similar extrapolations of the experimental phase shifts to high energies. N. M. B.

Spin-orbit coupling in the α-model of light nuclei. D. R. INGLIS (Physical Rev., 1939, [ii], **56**, 1175—1180; cf. A., 1937, I, 6).—In contrast to the case of the central-field model, the Thomas relativistic term for light nuclei approximated by the α-model is not in general larger than the Larmor magnetic term in the spin-orbit coupling. The relative magnitudes of these terms are estimated for the α-model of ^{7}Li and ^{13}C. The magnetic moment consistent with the Larmor–Thomas coupling in the α-model of ^{11}B is $\gg$ the experimental val. Angle-dependent nuclear forces arising from spin-orbit coupling are examined for ^{7}Li. N. M. B.

Distance between the energy levels of the atomic nucleus. P. O. MÜLLER (Physikal. Z., 1939, **40**, 615—617).—Mathematical. The agreement between experimental vals. of the average distance between energy levels of the nuclei $^{12}_{6}$C, $^{31}_{15}$P, and $^{44}_{20}$Ca and theoretical vals. calc. for the liquid drop model of the nucleus is best when vol. waves are neglected in the calculation. O. D. S.

Experimental refutation of the statistical view of the Bohr atomic model. J. STARK (Physikal. Z., 1939, **40**, 590—591).—It is argued that the observation that in a sufficiently strong electric field the red components of the H_δ line disappear disproves the statistical view of the Bohr model of the atom. A. J. M.

Multiple scattering of charged particles. A. E. RUARK (Physical Rev., 1940, [ii], **57**, 62; cf. Goudsmit, A., 1939, I, 507).—Mathematical. A treatment taking account of the effect of screening by at. electrons is developed. N. M. B.

Determination of the specific charge of the electron by the method of H. Busch. E. GOEDICKE (Ann. Physik, 1939, [v], **36**, 47—63; cf. Busch, Physikal. Z., 1922, **23**, 438).—$e/m_0 = (1\cdot7586\pm 0\cdot0023) \times 10^7$. O. D. S.

General theory of elementary corpuscles and the theory of the photon. G. PETIAU (J. Phys. Radium, 1939, [vii], **10**, 487—494).—Mathematical. By relating the photon theory of de Broglie with the outline of the structural theory of elementary corpuscles, the basis of a general corpuscular theory has been established wave-mechanically. W. R. A.

Mass of the neutrino. II. J. SOLOMON (J. Phys. Radium, 1939, [vii], **10**, 504—506; cf. A., 1939, I, 176).—Mathematical. W. R. A.

Dirac equation for a body with variable mass. I. I. PLACINTEANU (Bull. Acad. Sci. Roumaine, 1936—37, **18**, 8—11).—Mathematical. O. J. W.

Energy exchange between translation and rotation by collision. H. HABER (Physikal. Z., 1939, **40**, 541—551).—The band spectrum of AlH obtained with a cool hollow-cathode discharge in the presence of He, A, or Kr has been investigated. The energy exchange between translation and rotation in collision is determined only by the energies of the colliding particles and is unaffected by the momentary vals. of the impulse, the mass, or the relative velocities of the particles concerned. A. J. M.

Molecular binding energy between atomic hydrogen and aluminium atoms in aluminium. H. SCHÜLER, H. GOLLNOW, and E. FECHNER (Ann. Physik, 1939, [v], **36**, 328—334).—The unusual intensity of the $^1\Pi \rightarrow {}^1\Sigma$ transition bands of AlH is mainly due to evaporation of AlH mols. from the metal rather than formation of AlH in the gas space. The mol. binding energy between at. H and Al atoms in Al is $0\cdot228\pm0\cdot004$ ev. L. G. G.

Continuous absorption of nitrous oxide. H. SPONER and L. G. BONNER (J. Chem. Physics, 1940, **8**, 33—37).—Using a stainless steel absorption tube 105 ft. long and 1½ in. diameter, the absorption of N_2O has been measured from 3000 to 2400 A. The long-wave limit of the continuum shifts with pressure and new weak absorption is recorded and discussed. W. R. A.

Spectroscopic measurements of gaseous CN. I. Dissociation in the electric discharge. J. U. WHITE (J. Chem. Physics, 1940, **8**, 79—90).—The 0,0 and 1,1 bands of the $^2\Sigma \rightarrow {}^2\Sigma$ transition of CN,

produced by passing an electric discharge through gaseous C_2N_2, have been observed and from the intensity of the lines the relative concns. of CN have been calc. The rate of disappearance of CN after the end of the discharge does not alter over a wide pressure range nor on addition of A. The partial pressure of CN in C_2N_2–A mixtures, the abs. f val., and the [CN] in the C arc are discussed.

W. R. A.

Fluorescence of diacetyl. G. M. Almy, H. Q. Fuller, and G. D. Kinzer (J. Chem. Physics, 1940, **8**, 37—45).—When Ac_2 vapour or its aq. solution (1 : 50) is irradiated with light within its absorption band in the violet and near ultra-violet, it exhibits a vivid green fluorescence consisting mainly of three broad bands with max. at 5125, 5610, and 6135 A., on which is superimposed some finer structure. This is identical with that obtained when $COMe_2$ is excited with filtered 3130 A. radiation. There is an important difference, however, in that when Ac_2 is irradiated with weak or strong light (4358 A.) the fluorescence appears immediately with a const. intensity, whilst with $COMe_2$ the fluorescence rises gradually from almost zero intensity. This is explained by assuming that the fluorescing mol. in both cases is Ac_2. Since 3130 A. causes $COMe_2$ to fluoresce but not Ac_2, the fluorescence of $COMe_2$ must be due to a collision of the second kind, Ac_2 against excited $COMe_2$, or as a result of a three-body collision between Ac_2 and two combining radicals, in which the energy released in recombination excites the Ac_2. The fluorescence spectrum of Ac_2 is insensitive to changes in $[Ac_2]$ (0·1 to 50 mm.), temp. (10—100°), exciting λ (3650—4358 A.), or added O_2, which quenches the fluorescence strongly. The ratio of the intensity of fluorescence to light absorbed is independent of the pressure, and the intensity of fluorescence $\propto$ exciting intensity at const. pressure. The quenching of fluorescence by O_2 follows the Stern–Volmer law over a pressure range in which the fluorescence drops to 20% of the initial intensity; at higher pressures the intensity of fluorescence falls more rapidly. The O_2 is consumed in the quenching process, and the fluorescence returns to full intensity. The life-time of the fluorescing mol. is $\sim 10^{-5}$ sec. These data can be explained by assuming that the Ac_2 mol. emits fluorescence after excitation and redistribution (spontaneous and through collisions) of its vibrational energy.

W. R. A.

Fluorescence and absorption measurements with benzene derivatives, especially with condensed systems. H. Ley and H. Specker (Z. wiss. Phot., 1939, **38**, 96—110; cf. A., 1939, I, 404).—Anthracene (I) in hexane solution shows five fluorescence bands with max. at λ 3780, 3815, 4025, 4240, 4450 A.; the strong absorption (data from the literature) and fluorescence are ascribed to the special linkage of $C_{(9-10)}$. 9 : 10-Dihydroanthracene has only one fluorescence band at 2720—3400 A. (max. 2900 A.); other bands are due to impurity of (I). The pure substance also shows only one absorption band, in the short ultra-violet. Octahydroanthracene shows absorption bands at 2860—2700 (marked max. at 2830) and 2030; the fluorescence band is 2870—3450 (max. 3020 A.). These bands correspond with those of C_6H_6, and prove their constitution as true C_6H_6 derivatives. Introduction of NH_2 (β-anthramine) shifts both absorption and fluorescence bands towards long λ. With salts of anthramine, the spectra weaken and tend to resemble those of (I). The relations between mol. refraction and absorption or fluorescence are discussed. Displacement of bands towards the red is parallel with increase of refraction, and corresponds with a decrease in energy required to shift an electron to a higher quantum level.

J. L.

Ultra-violet absorption spectra of the vapours of monohalogenated toluene derivatives. II. H. Ţintea (Bull. Acad. Sci. Roumaine, 1939, **22**, 16—18).—The absorption spectra of o-C_6H_4MeX vapours (X = F, Cl, Br) contain numerous bands which form doublet series with three fundamental $\nu\nu$; $\nu - \nu' = 156$, 66, and 65 cm.$^{-1}$, respectively. An analysis of the principal band-heads and series formulæ for ν and ν' are given.

A. J. E. W.

Absorption of certain phenylhydrazides in the medium ultra-violet. (Mlle.) D. Biquard and P. Grammaticakis (Bull. Soc. chim., 1939, [v], **6**, 1599—1615).—The absorption spectra of 20 acyl and alkyl–acyl derivatives of $NHPh{\cdot}NH_2$ in EtOH solution have been studied in the region $\lambda\lambda$ 4285—2000 A. The results indicate that the compounds exist mainly in the form of true phenylhydrazides. Substitution of a H at β changes only slightly the absorption spectrum of $NHPh{\cdot}NH_2$, but substituents at α modify it considerably. The form of absorption curve shown by αβ-substitution products depends on the nature of the α-substituent.

J. W. S.

Ultra-violet absorption spectra of some oxygenated acridine derivatives: acridine *N*-oxide, acridone, 5-hydroxyacridine *N*-oxide and its sodium salt, and 5-methoxyacridine *N*-oxide. G. A. Dima and P. Pogângeanu (Bull. Acad. Sci. Roumaine, 1939, **22**, 19—22; cf. A., 1939, I, 354).—$\lambda\lambda$ of absorption max. (2200—4700 A.) and absorption curves are given. The effect of substitution is examined.

A. J. E. W.

Ultra-violet absorption spectra of some derivatives of 1 : 2-benzanthracene. R. N. Jones (J. Amer. Chem. Soc., 1940, **62**, 148—152).—The ultra-violet absorption spectra of 1 : 2-benzanthracene and of 10 Me_1 and Me_2 derivatives are very similar in shape and intensity. The variation in the bathochrome shift of the position of the max. of the most intense band due to the position of alkyl substitution seems to be correlated with the variation in the carcinogenic activity of the hydrocarbons. The spectrum of 1 : 9-methylene-1 : 2-benzanthracene differs markedly from those of the other derivatives, due possibly to steric strain in the mol.

W. R. A.

Absorption spectrum of hypericin. N. Pace and G. Mackinney (J. Amer. Chem. Soc., 1939, **61**, 3594—3595).—The spectrum of hypericin in abs. EtOH confirms that of Dhéré and Castelli (A., 1939, III, 1007). Spectra in aq. and abs. $COMe_2$, $COMe_2$ + Et_2O, Et_2O, Et_2O + C_5H_5N, and C_5H_5N are recorded and discussed. In Et_2O an additive compound is

possibly formed which co-exists with the mol. species (I) found in abs. EtOH or Et_2O-$COMe_2$ mixtures. In presence of H_2O or C_5H_5N (I) disappears and a spectrum characteristic of a different mol. species is obtained. In $COMe_2$ the fluorescence is a vivid red, whilst in Et_2O it is orange. W. R. A.

Spectrum of bilirubin in alkaline media.—See A., 1940, III, 137.

Optical properties of quartz at wave-lengths of 8—30 μ. W. STEIN (Ann. Physik, 1939, [v], **36**, 462—484).—The transmissibility of cryst. and amorphous quartz has been determined. That of cryst. quartz shows strong dichroism, and the substance is particularly transparent to light of λ 16·5 μ. This is not the case with quartz glass. The absorption coeffs. for cryst. and amorphous quartz have been determined and are plotted against λ. A. J. M.

Partial and total emissive power of some substances. IV. A. CARRELLI (R.C. Atti Accad. Lincei, 1939, [vi], **29**, 664—671; cf. A., 1939, I, 557). —Measurements of the emissive power from 1 to 7 μ. in the temp. range 500—1200° K. are recorded for $CaSO_4$, $SrSO_4$, MgO, CaO, ZnO, BeO, FeO, Cu_2O, Fe_2O_3, and CuO. O. J. W.

Coriolis perturbations in the spectra of silane and germane. G. M. MURPHY (J. Chem. Physics, 1940, **8**, 71—78).—The method of Jahn (A., 1939, I, 119) has been used to compute a Coriolis perturbation for SiH_4 and GeH_4 on the rotational structure of the fundamental frequency, ν_4. The theoretical spectra are in good agreement with those observed. The Q branch for SiH_4 degrades towards lower νν, and in GeH_4 it degrades towards higher νν owing to the relative position of the infra-red inactive frequency, ν_2, on which the perturbation depends. Matrix elements of the Coriolis operator have been obtained for a large no. of lines. W. R. A.

Absorption of coloured inorganic salt solutions in the near infra-red. T. DREISCH and O. KALLSCHEUER (Z. physikal. Chem., 1939, **B**, **45**, 19—41).—Aq. solutions containing inorg. cations absorb in the following regions: Fe^{II} 0·680—1·400 μ. (max. 0·960), Fe^{III} 0·700—1·200 (max. 0·770—0·840), VO^{III} 0·803—0·784, V^{III} 0·840—0·862, V^{V} 0·610, Ti^{II} 0·738 —0·744, U^{IV} 0·700—0·900, 1·000—1·200, and 1·300—1·800 μ. Mn^{II} salts show no absorption in the infra-red region, but acidified Cr^{III} salts absorb at 0·770—0·792 μ. In most cases a fine structure has been detected in the bands. The small variations of the absorption bands with differing anions and the same cation are attributed to hydration effects. The anomalous absorption of $FeBr_3$ is ascribed to the presence of $Fe^{\cdot\cdot}$ ions. In each case it is observed that the lower valency ions of a metal absorb at longer λλ than the higher valency states. J. W. S.

Effect of ions of lyotropic series on the infra-red absorption spectrum of water. A. M. BUSWELL, R. C. GORE, and W. H. RODEBUSH (J. Physical Chem., 1939, **43**, 1181—1184).—The influence of KCl, KBr, KI, KNO_3, and KCNS on the 3 μ. absorption band of H_2O has been investigated. Whilst the effect of halogen ions on the mol. absorption coeff. is in a lyotropic sequence parallel with the respective halogen ionic radii, the corresponding effects of NO_3' and CNS' are less easy to explain on account of the opposing effects of depolymerisation of the liquid structure and of electrostatic orientation of H_2O mols. around the dissolved ion which respectively increase and decrease absorption. C. R. H.

Infra-red OH band and association. J. ERRERA, R. GASPART, and H. SACK (J. Chem. Physics, 1940, **8**, 63—71).—The infra-red absorption of different concns. of EtOH in CCl_4 has been investigated for the 3 μ. region at different temp. The monomeric band appears at 3638 cm.$^{-1}$; its intensity is not appreciably altered by concn. but increases with rising temp. The polymeric band is at ~3300 cm.$^{-1}$; its intensity increases as the [EtOH] increases but diminishes at higher temp.; its shape alters with increased temp. and a new max. appears at 3523 cm.$^{-1}$, which is attributed to dimerides since, *inter alia*, a corresponding band is found for EtOH in $COMe_2$, and at room temp. with dil. solutions in CCl_4 ($\ngtr$1%). With conc. solutions (2—8%) numerous multimol. complexes will break up to bimol. as the temp. rises and the ~3520 cm.$^{-1}$ band will appear, but with dil. solutions ($\nless$1%) very few multimol. complexes will exist and at higher temp. bimol. complexes will decompose into monomols., which explains the observed diminution in intensity of the 3520 cm.$^{-1}$ band. On cooling dil. solutions to −5° the multimol. band re-appears. Only at [EtOH] < 0·12% is the monomeride present alone, but in the gaseous state even at 80° and 0·12% EtOH bands due to associated mols. are observed. Similar results are found for CS_2 solutions of EtOH. Following Fox and Martin (A., 1938, I, 60), the concns. of single and multi-mols. have been estimated for the various solutions. It is not possible, however, to explain completely the "mechanism" of association in EtOH; the infra-red data do not decide if association takes place electrostatically or as a result of H-bonding. The spectra of ternary mixtures of x% EtOH, $(10-x)$% $COMe_2$ or C_5H_5N, and 90% CCl_4 and 2% EtOH, 49% C_5H_5N, and 49% dioxan have been investigated at different temp. and evidence of mono-, di-, and multi-mols. and of additive compounds between EtOH and C_6H_5N, or $COMe_2$, or dioxan is obtained. The influence of temp. and concn. changes on the location and intensity of characteristic bands is discussed. The bands for the additive compounds of EtOH with $COMe_2$ and C_5H_5N are respectively at 3500 and 3350 cm.$^{-1}$, indicating that the interaction between EtOH and C_5H_5N is > that between EtOH and $COMe_2$. Solutions of HDO in D_2O, $COMe_2$, C_5H_5N, and dioxan and a saturated solution of KI have also been studied in the same region. The OH vibration gives the same band in H_2O and in a solution of HDO in D_2O. Unlike H_2O in O-containing solvents, HDO does not give a double band. W. R. A.

Infra-red absorption studies. IX. Bonding of hydrogen in nitrogen compounds. A. M. BUSWELL, J. R. DOWNING, and W. H. RODEBUSH (J. Amer. Chem. Soc., 1939, **61**, 3252—3256).—The N–H absorption of NH_2Ph, 2-nitro- and 2-nitro-6-methyl-acetanilide (all in CCl_4) and liquid pyrrole (I) is discussed. In dil. solution (I) has a band at

2·85 μ. and liquid (I) has the corresponding band at 2·93 μ. With C_5H_5N or $NHBu_2$ (I) exhibits bands at 3·11 and 3·14 μ., attributable to N–H→N bonding. In glycylglycine Et ester in CCl_4 evidence of O–H bonding occurs and the absorption behaviour resembles that of monosubstituted amides. The benzenesulphonamide of *cyclo*hexylamine behaves similarly. Absorption due to N–H bonds is < that due to O–H and the characteristic ν varies to a greater extent. H-bonding with N cannot be investigated by infra-red methods with the same reliability as H-bonding with O. W. R. A.

Infra-red and Raman spectra of polyatomic molecules. X. C_2D_2, C_2DH, and C_2H_2. F. STITT. **XI. Dimethyl sulphide, Me_2S.** R. FONTEYNE (J. Chem. Physics, 1940, **8**, 56—59, 60—62).—X. The infra-red absorption from 2 to 22 μ. of C_2D_2, C_2DH, and C_2H_2 has been determined from measurements of C_2H_2 and two isotopic mixtures. C_2H_2 and C_2D_2 have point-group symmetry $D_{\infty h}$ whilst C_2DH has $C_{\infty v}$ and the types of normal modes of vibration are discussed. Observed νν are compared with vals. calc. on the basis of a simple potential function (cf. Colby, A., 1935, 562). From these and Raman data assignments of 28 observed bands have been made; two bands are not assigned.

XI. Me_2S has symmetry C_{2v}; the normal modes of vibration and their spectroscopic activities are discussed. The infra-red spectrum of gaseous Me_2S from 2 to 26 μ., the Raman spectrum of liquid Me_2S, and the polarisation of the Raman lines have been investigated. Tentative assignments are made. W. R. A.

Absorption spectra of sugars in the near infra-red. E. S. BARR and C. H. CHRISMAN (J. Chem. Physics, 1940, **8**, 51—55).—Infra-red absorption spectra from 1·7 to 4·6 μ. are recorded for *d*- and *l*-arabinose, β- and *d*-glucose, *d*-mannose, *d*-xylose, *l*-rhamnose, *d*-fructose, *d*-galactose, sucrose, maltose, *d*- and β-lactose. Practically identical spectra are obtained from all. Two new bands are reported at 2·16 and 2·35 μ. W. R. A.

Infra-red studies of the porphyrin molecule. C. S. VESTLING and J. R. DOWNING (J. Amer. Chem. Soc., 1939, **61**, 3511—3513).—The infra-red absorption spectra of 5′-bromo-3′ : 4-dicarbethoxy-3 : 4′ : 5-trimethyl- (I) and 4 : 4′-dicarbethoxy-3 : 5 : 3′ : 5′-tetramethyl-dipyrrylmethene (II), the Cu complex of (II), ætioporphyrin I (III), and ætiohæmin I chloride have been investigated. N–H absorption is eliminated by replacement of acidic H in (I), (II), and (III) by metals. The possibility of N–H–N bonding is discussed. W. R. A.

Infra-red absorption spectra of purple bacteria.—See A., 1940, III, 166.

Infra-red absorption spectra of chlorophyllous pigments.—See A., 1940, III, 175.

Hydrogen peroxide and its derivatives. III. Raman spectra of D_2O_2 and HDO_2. F. FEHER (Ber., 1939, **72**, [*B*], 1778—1788).—The frequency 877 cm.$^{-1}$ persists unchanged in H_2O_2, HDO_2, and D_2O_2 and therefore corresponds with a valency vibration of O to O. H and D atoms scarcely participate in this vibration. The OH frequency and the band 1421 cm.$^{-1}$ change by transition from H_2O_2 to D_2O_2 by the approx. factor $1/\sqrt{2}$, as would be theoretically expected of H and D atoms are exclusively concerned with these vibrations. The frequency 1421 cm.$^{-1}$ corresponds with a deformation vibration and not with a O–O semipolar double linking. The spectrum of HDO_2 is composed additively from those of H_2O_2 and D_2O_2. The similar behaviour (with consideration of the resonance fission) of all investigated H–D compounds shows that the five frequencies in the spectrum of the mixture are to be ascribed to the H_2O_2 mols. Comparison of the spectra of these peroxides proves that the three frequencies observed with H_2O_2 and D_2O_2 frequently comprise the complete Raman spectrum (apart from the vibration around the O–O axis). In consequence of resonance there is a coincidence of a symmetrical and antisymmetrical valency or deformation vibration so that the OH bands (corresponding with OD) and the deformation bands are doubled. Application of Mecke's method of treating the vibration problems of mols. with several similar linkings shows that the above-mentioned resonance can be expected only if the OH groups are placed at an angle of 90° to one another as suggested by Penney and Sutherland from quantum-mechanical observations. The absorption spectrum of H_2O_2 and the arrangement of the frequencies by Bailey and Gordon (A., 1938, I, 494) are discussed. H. W.

Effect of crystal orientation on the Raman spectrum of calcite. S. BHAGAVANTAM (Current Sci., 1939, **8**, 507—508).—The Raman spectra of $CaCO_3$ with different orientations of a single crystal are compared with those of Nedungadi (A., 1940, I, 9) for $NaNO_3$ and similar conclusions are reached. Weak lines due to internal oscillations have not been found. The views of Nedungadi regarding internal oscillations are criticised. W. R. A.

Raman spectroscopic studies. XVI. Structure of permonosulphuric acid. A. SIMON [with G. KRATZSCH] (Z. anorg. Chem., 1939, **242**, 369—374).—The Raman spectrum of anhyd. H_2SO_5 shows a large no. of lines, implying a very unsymmetrical structure. The OH band (3420—3567 cm.$^{-1}$) is present, but there are no indications of an SH vibration (∼2500 cm.$^{-1}$). It follows that H_2SO_5 is a dibasic pseudo-acid, with no H directly bound to S. F. J. G.

Raman and infra-red spectra of the halogen derivatives of methane. H. VOLKRINGER, J. LECOMTE, and A. TCHAKIRIAN (J. Chem. Physics, 1940, **8**, 126).—Data on chlorobromo-derivatives of CH_4 (A., 1938, I, 295) are compared with those for CCl_3F (A., 1939, I, 301) and CCl_2F_2 (A., 1932, 897). W. R. A.

Raman effect of chlorobromofluoromethane. G. GLOCKLER and G. R. LEADER (J. Chem. Physics, 1940, **8**, 125).—Liquid CHClBrF gives 11 Raman lines and has $\rho^{16} = 1·994$, b.p. 38—39°/734 mm. No evidence of photochemical decomp. was obtained. W. R. A.

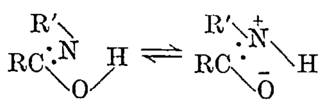
Raman effect. CVII. Methylene derivatives. J. WAGNER (Z. physikal. Chem., 1939, **B**, **45**, 69—91;

cf. A., 1938, I, 386, 556).—Data are recorded for CH_2Cl_2, CH_2Br_2, CH_2I_2, CH_2ClBr, CH_2ClI, CH_2BrI, EtCl, EtBr, and EtI and are analysed. The force consts. and internuclear distances in CH_2Cl_2, CH_2Br_2, and CH_2I_2 are evaluated. J. W. S.

Raman spectra of some geometrical isomerides. B. K. VAIDYA (J. Univ. Bombay, 1939, 8, Part 3, 126—133).—Raman spectra for Me maleate, fumarate, citraconate, and mesaconate are recorded (cf. Briner *et al.*, A., 1939, I, 180). These mols. and *cis*- and *trans*-$C_2H_2Cl_2$ are compared with the C_2H_4 mol. F. R. G.

Raman spectra of acetylenes. II. Displacement and depolarisation factors for phenylacetylene and derivatives of the type $C_6H_5{\cdot}C{\vdots}CR$. M. J. MURRAY and F. F. CLEVELAND (J. Amer. Chem. Soc., 1939, 61, 3546—3549).—Raman spectra of CPh:CR (R = H, Me, Cl, CH_2Cl, $CH_2{\cdot}OH$, CH_2Br, Et, $[CH_2]_2{\cdot}Cl$, $[CH_2]_2{\cdot}OH$, $[CH_2]_3{\cdot}Cl$, CH_2Ph, CHMe·OH) and the depolarisation factors of the lines, particularly those at ~2200 cm.$^{-1}$, are recorded and discussed. Since the two lines in the 2200 cm.$^{-1}$ region are depolarised to the same extent the explanation of Glockler and Davis (A., 1934, 146), that one is symmetrical and the other asymmetrical, is untenable. The probable origin of these two lines is discussed. W. R. A.

Constitution of peptides. II. Raman spectra and structure of amides. C. SANNIÉ and V. POREMSKI (Bull. Soc. chim., 1939, [v], 6, 1629—1649; cf. A., 1937, II, 271).—Raman spectra of NH_2Ac, NHAcEt, $NAcEt_2$, and OEt·CMe:NH (I), pure, or in solution in H_2O, CCl_4, or aq. HCl, are examined. In certain regions, the no., intensity, and position of bands vary considerably with the nature of the amide and the medium; correlation of results with varying structural forms suggests that characteristic bands, although displaced in substituted amides, correspond with sp. forms. Amides exist, probably, mainly in the resonance form (*A*) (cf. Kumler *et al.*, A., 1935, 283), or may also be in equilibrium with other forms, *e.g.*, association complexes.



(*A*.)

Equilibrium varies with the amide and medium. The amount of imino-form [cf. spectrum of (I)] is negligible with $HCO{\cdot}NH_2$, considerable with NH_2Ac, and small with NHAcEt; it is favoured in aq. solution. The band probably corresponding with the amide form is present only with NH_2Ac. In HCl, there is a band corresponding with ionisation. A. T. P.

Raman effect: characteristic frequency of the double linking of imines. A. KIRRMANN and P. LAURENT (Bull. Soc. chim., 1939, [v], 6, 1657—1663).—The Raman spectra of 9 aliphatic and cyclic imines of the form R·CH:NR′ all show a frequency at ~1670 cm.$^{-1}$, attributable to the C:N linking and approx. = the frequency (~1675 cm.$^{-1}$) attributable to the C:C linking. The C:N linking contributes 0·9 to the mol. refraction. J. W. S.

Experimental investigation of the processes of light emission. O. DEUTSCHBEIN (Ann. Physik, 1939, [v], 36, 183—188).—The fluorescence of single crystals of some Eu salts of different symmetry classes has been investigated. Some groups of lines in the emission and absorption spectra are to be ascribed to an electric dipole, and others to a magnetic dipole. A. J. M.

Charge potential, secondary emission, and fatigue phenomena of electron-irradiated metals and luminescent substances. C. HAGEN (Physikal. Z., 1939, 40, 621—640).—Using cathode-ray tubes with (1) a metal screen in place of the usual luminescent material and (2) various luminescent screens, measurements have been made on the relation between screen potential and accelerating voltages, and on the method of discharge by the screen of the potential acquired by impact of the cathode ray. The latter is effected by secondary electron emission, and direct measurements of this current are recorded in relation to the anode accelerating voltages. The charging-up processes of insulated screens (metallic and luminescent) are shown to be similar in their relationship to the anode pontentials, and the mechanism is discussed. Curves are also given for the decay in light-sensitivity of the luminescent materials with prolonged illumination; this is due to actual blackening of the screen by released metal and to disturbance of the light-sensitive centres in the crystal lattice. L. G. G.

Decay of alkali halide phosphors activated by thallium. V. ANTONOV-ROMANOVSKI and G. KOTSCHERGIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, 24, 430—432).—The exponential decay of phosphorescence in KCl–Tl phosphors is not regarded as proof that the process is unimol. A theoretical relationship is deduced for the decay of luminescence. H. J. E.

Luminescence and absorption of zinc sulphide, cadmium sulphide, and their solid solutions. F. A. KRÖGER (Physica, 1940, 7, 1—12).—ZnS–CdS mixed crystals show a continuous shift of the fundamental absorption edge to longer λλ in passing from pure ZnS to pure CdS. At −180° an emission band is found at all compositions, immediately adjacent to the long-λ side of the fundamental absorption. In the ranges 0—10 mol.-% CdS and 0—10 mol.-% ZnS, fine structure consisting of at least five equidistant bands 360 cm.$^{-1}$ and 320 cm.$^{-1}$ apart, respectively, is visible. For low-temp. emission and for absorption, λλ for wurtzite and sphalerite differ by ~500 cm.$^{-1}$ CdS and mixtures with $\not>$50 mol.-% ZnS also show narrow emission bands of relatively low intensity and dependent on crystal size, inside the fundamental absorption region. ZnO in the ultra-violet shows emission and absorption similar to that of ZnS and CdS. L. J. J.

Luminescence and absorption of solid solutions in the ternary system ZnS–CdS–MnS. F. A. KRÖGER (Physica, 1940, 7, 92—100).—At 900° solid MnS–ZnS–CdS solutions containing up to ~50 mol.-% MnS can be obtained. The absorption spectrum consists in all cases of a system of bands

characteristic of Mn and the fundamental absorption bands. The former is independent of composition and identical with that found in ZnS–MnS. The latter consist of two bands, found in ZnS and CdS, and in MnS, respectively. All ternary crystals show a lattice emission band, with a max. at λλ depending on composition and varying from blue with pure ZnS to infra-red with pure CdS. At $-180°$ additional emission bands characteristic of Mn are found. ZnS–MnS crystals made by co-pptn. without heating showed photoluminescence in the same emission bands as those made at high temp. L. J. J.

Decay of luminescence in certain classes of luminescent substances (Al_2O_3–Cr, CdI_2–$MnCl_2$, Zn_2SiO_4–Mn). V. N. ALJAVDIN, V. V. FEDOROV, and V. L. LEVSCHIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 106—110).—The decay of the luminescence of Al_2O_3–Cr and of lamellar phosphors prepared from CdI_2 and $MnCl_2$ obeys an exponential law with mean durations of luminescence, τ, 0·016 and $5·8 \times 10^{-4}$ sec., respectively. The luminescence of CdI_2–$MnCl_2$ phosphors consists of a band from 640 to 720 mμ. and is decreased by rise in temp. τ is independent of concn. of $MnCl_2$ from 5 to 50%. When the excitation period is short, 0·001 sec., the decay of luminescence of willemite is exponential in the early stages up to 0·12 sec., with τ 0·01 sec. The decay of luminescence of willemite at later stages, 0·3—20 sec., obeys a hyperbolic law with decay index $\leqslant 2$, indicating that two processes are superimposed in the luminescence. O. D. S.

Mitogenetic radiation accompanying neutralisation of strong acids and bases. A. RABINERSON and M. VLADIMIRSKAJA (Acta Physicochim. U.R.S.S., 1939, **11**, 403—408; cf. A., 1939, I, 621).—Analysis of short-wave radiation emitted during the interaction of N-HCl and N-NaOH shows it to be identical with that emitted by irradiated glycine in presence of NaCl (cf. Gurvitsch, A., 1939, I, 620). It is supposed that in both cases Na˙ and Cl′ are excited by the energy released in the solutions. The radiation is mostly absorbed by saturated aq. NaCl, and this accounts for the smaller effect obtained with 5N. solutions of the reactants. F. L. U.

Back effect of metastable atoms and decrease in breakdown potential in inert gases. W. ROGOWSKI (Naturwiss., 1939, **27**, 755—756).—Theoretical. A. J. M.

Photo-potential of the element metal–semiconductor–metal. V. Polycrystalline cuprous oxide at low temperatures. G. MÖNCH (Ann. Physik, 1939, [v], **36**, 1—8; cf. A., 1936, 148).—A p.d. between the Cu electrodes was observed for the element Cu–Cu_2O–Cu when one Cu–Cu_2O junction was illuminated at liquid air temp. O. D. S.

Calculation of absorption with the Drude–Coolidge apparatus. H. SLÄTIS (Ann. Physik, 1939, [v], **36**, 397—412).—A new method of calculating the absorption coeff. of a dielectric from the results of observations with the Drude–Coolidge apparatus is given. The ratio of the max. galvanometer deflexion with and without the condenser containing the dielectric in the Lecher system is used, but the resonance curve is not required. A. J. M.

Dipole moments and structures of chlorine compounds of germanium, chromium, selenium, and tellurium. C. P. SMYTH, A. J. GROSSMAN, and S. R. GINSBURG (J. Amer. Chem. Soc., 1940, **62**, 192—193).—The dipole moments of GeH_3Cl vapour and of CCl_4 solutions of GeH_2Cl_2, CrO_2Cl_2, $SePh_2Cl_2$, and $TeCl_4$ are respectively 2·03, 2·21, 0·47, 3·47, and 2·54 D. The bearing of these data on the moments of linkings and on the structure of the mols. is discussed. W. R. A.

Absorption by dipole liquids and electrolytes in the region of short electric waves. K. SCHMULE (Ann. Physik, 1939, [v], **35**, 671—689).—The absorption has been measured at λλ from 10 to 20 m. for $(CH_2·OH)_2$, H_2O, $PhNO_2$, $COMe_2$. PhCl, and aq. solutions, with and without addition of sugar, of cetylpyridinium chloride (I). A selective absorption of sugar-containing solutions of (I) was observed. O. D. S.

Dispersion and absorption of electric waves in alcohols and aqueous solutions. K. E. SLEVOGT (Ann. Physik, 1939, [v], **36**, 141—165).—An audio-frequency bridge with compensating wire resistances is described, and a method of determining the dielectric const. of conducting liquids in the short-wave region is given. The method was used with H_2O, solutions of gelatin and sugars, and the first five alcohols. The electrical data obtained for H_2O and the alcohols agree well with Debye's theory. Sugar solutions, on the other hand, do not agree with the theory. A. J. M.

Heavy Seignette salt; dielectric investigations on $KNaC_4H_2D_2O_6,4D_2O$ crystals. J. HABLÜTZEL (Helv. Phys. Acta, 1939, **12**, 489—510).—The dielectric const. in the directions of the 3 principal axes, and dielectric hysteresis and saturation effects, have been compared for $KNaC_4H_4O_6,4H_2O$ (I) and $KNaC_4H_2D_2O_6,4D_2O$ (II) at $-180°$ to 60°. For the *a* axis, the "Curie points" are at $-18°$ and 23° for (I), and $-22°$ and 35° for (II); below this temp. region ϵ is greater for (I) than for (II). For the *b* and *c* axes, ϵ also increases with temp., vals. for (I) being slightly > for (II) at low temp.; only a slight inflexion is found in the crit. temp. region. ϵ is independent of frequency between 100 and 10^4 Hz. Remanent polarisation has a max. val. $2·5 \times 10^{-7}$ coulomb per sq. cm. for (I), and $3·7 \times 10^{-7}$ coulomb per sq. cm. for (II), both at ~0°. The max. coercivity is ~200 v. per cm. at ~15° for (I), and ~400 v. per cm. at ~18° for (II). Hysteresis losses and deformation of hysteresis curves by mechanical vibrations increase with frequency up to 10^5 Hz., being greater for (II) than for (I). The results are in agreement with the presence of polar H links. L. J. J.

Influence of molecular shape and of freely rotating dipole groups on dielectric relaxation. A. BUDÓ (Physikal. Z., 1939, **40**, 603—610; cf. A., 1939, I, 302).—Mathematical. A mol. with *n* dipole groups, rotating freely about axes fixed with respect to mol. co-ordinates but of any direction, will have $n + 3$ times of relaxation. The relation between the

times of relaxation and the corresponding frictional quantities is given. O. D. S.

Dielectric relaxation with regard to molecular and intermolecular structure of dipolar liquids. E. Fischer (Physikal. Z., 1939, **40**, 645—663: cf. A., 1939, I, 127, 302).—Measurements of dielectric loss on polar mols. in dil. (C_6H_6) solution show that for mols. with fixed dipoles the theory of Perrin applies, with the associated assumptions on intermol. friction. For mols. with an axis of free rotation the relaxation time is dependent on the angle between the dipole and this axis. Comparison of results with relaxation times for the pure polar liquids shows agreement with Debye's theory of quasi-cryst. structure in the cases of $COMe_2$, $PhNO_2$, and PhCl, but inconsistencies occur with alcohols. These are explained by a separate structural theory based on the work of Hackel (A., 1937, I, 221). L. G. G.

Dipole moment of 1-chloroanthraquinone. E. Bergmann and A. Weizmann (J. Amer. Chem. Soc., 1939, **61**, 3583).—Polemical against Fischer and Rogowski (A., 1939, I, 303). Vals. for μ are 1·8—1·9 D. W. R. A.

Viscosity dispersion of the dielectric constants of organic liquids at very high frequencies ($\lambda = 15$ cm.). R. Odenwald (Ann. Physik, 1939, [v], **35**, 690—700; cf. A., 1939, I, 557).—ϵ of solutions of $PhNO_2$ in a mineral oil of high η has been measured at λ 15 cm., temp. 12—30°, and concn. 2·5—17 wt.-%. Viscosity dispersion was observed to begin, in all solutions, at temp. > that observed by Plötze for λ 60 cm. (*loc. cit.*), but about the same for all except the solution of lowest concn. The limiting val., at high temp., of ϵ at λ 15 cm. is < that at λ 60 cm. for all concns. O. D. S.

Dioximes. CXXIV.—See A., 1940, II, 58.

Dielectric properties of glycerides. II. B. V. Bhide and R. D. Bhide (J. Univ. Bombay, 1939, **8**, Part 3, 220—234).—The dielectric consts. of glycerides have been determined at 1000, 4400, and 5700 kc. per sec. over a range of temp. (5—88°) and under conditions which permit isomeric changes. The following vals. are recorded for α-monomyristin: α-form 8·58 at 38·2°, β'-form 2·86 at 40°, β-form 2·41 at 40°, liquid 5·84 at 75·9°; for α-monostearin: α-form 4·96 at 40°, β-form 2·40 at 40°, liquid 4·30 at 87·7°. F. R. G.

Dipole moment of cedrene. S. Kambara (J. Soc. Chem. Ind. Japan, 1939, **42**, 314—315B).—μ is 0·37—0·39 $\times 10^{-18}$ e.s.u. between 15° and 35°. W. A. R.

Dielectric evidence of molecular rotation in the crystals of certain (A) non-aromatic compounds. A. H. White and W. S. Bishop. **(B) Benzene derivatives.** A. H. White, B. S. Biggs, and S. O. Morgan (J. Amer. Chem. Soc., 1940, **62**, 8—16, 16—25).—(A) Dielectric evidence for the rotation of polar mols. has been obtained with the crystals of 21 compounds (2 derivatives of C_2H_6, 1 of *cyclo*pentane, 5 of *cyclo*hexane, and 13 of camphane). For most the dielectric const. (ϵ) rises sharply at a transition temp. to a val. characteristic of polar liquids. A relatively symmetrical gravimetric and volumetric distribution of atoms around the centre of gravity of the mol. apparently facilitates its rotation in the crystal. Among the cyclic polymethylene derivatives the attachment of a large substituent to the ring inhibits mol. rotation, and in the *cyclo*hexanones and in *cyclo*pentanol substitution of Me has the same effect. Mol. rotation is more noticeably correlated with the gross physical properties of the crystal rather than with the chemical structure of the mol. Thus, crystals in which there is no mol. rotation at room temp. are hard and brittle, whilst those in which the mols. rotate at room temp. are soft and waxy. A significant feature of crystals exhibiting mol. rotation is the low heat of fusion.

(B) Dielectric data supply two kinds of evidence of mol. rotation in certain aromatic crystals: (i) ϵ of the solid behaves like that of the corresponding liquid, and (ii) among these solids ϵ may be correlated with the dipole moment of the mol. ϵ of the solids at the highest temp. was > that of the liquids, indicating that the mols. rotate as freely in the solid as in the liquid. Since a permanent dipole cannot affect ϵ except through rotational motion, (ii) is convincing evidence for rotation. The similarity of behaviour of ϵ with temp. to that of compounds in (A) is noted. A function proposed recently (A., 1939, I, 128) to describe the interaction of a mol. with its neighbours is used to explain the peculiar temp. variation of the static polarisation of 1:2:3:4:5:6-$C_6Me_3Cl_3$. W. R. A.

Magnetic rotation of praseodymium, samarium, and europium chlorides in aqueous solution at 25°. C. M. Mason, J. W. Hickey, and W. K. Wilson (J. Amer. Chem. Soc., 1940, **62**, 95—99).—The magnetic rotations of aq. $PrCl_3$, $SmCl_3$, and $EuCl_3$ have been measured at 25° for $\lambda\lambda$ 4810·5, 5085·8, 5460·7, 5893, 6362·4, and 6438·5 A. except when absorption interfered. The calc. Verdet consts. (min. per gauss per cm.) are recorded, those of $SmCl_3$ and $EuCl_3$ being positive for all $\lambda\lambda$ and molalities, whilst for $PrCl_3$ they are positive up to ~1·0M. and afterwards negative. The sp. and mol. rotations have been calc., and their variation with concn. is discussed. The n of the different solutions at the various $\lambda\lambda$ are recorded. W. R. A.

Structure of solid hydrogen fluoride. P. Günther and K. Holm (Z. physikal. Chem., 1939, **B**, **44**, 474).—A correction (cf. A., 1939, I, 457). A. J. E. W.

Raman spectroscopic studies. XV. Constitution of orthophosphoric acid and its salts. A. Simon and G. Schultze (Z. anorg. Chem., 1939, **242**, 313—368; cf. A., 1937, I, 167).—With a view of elucidating its structure, the Raman spectra of H_3PO_4 have been studied and compared with those of its salts and other derivatives. Earlier work on anhyd. H_3PO_4 is often vitiated by the use of preps. contaminated with $H_4P_2O_7$, such as are always formed when the conc. acid is evaporated (even at the lowest temp. possible in a high vac.), or treated with P_2O_5 or $POCl_3$, but these products afford the pure anhyd. acid on crystallisation. Its m.p. is 41·5° and it is stable in the solid state but $H_4P_2O_7$ soon forms in the melt. The anhyd. and aq. acids, and aq. solutions of the primary and tertiary alkali salts, all

give approx. the same Raman spectrum, consisting of four lines, and, contrary to the findings of Médard (A., 1934, 583), the OH band cannot be detected in the spectrum of the anhyd. acid. The spectrum of the conc. aq. acid is not affected by saturation with HCl. A solution of H_3PO_4 in EtOAc shows a new line (1697 cm.$^{-1}$), which may be due to the unpolymerised mol., and appears to correspond with lines of lower frequency shown by $PO(OMe)_3$ and $POCl_3$. For comparison, Raman spectra of PCl_3, $PSCl_3$, and $PS(OMe)_3$ are also given. Substitution of D for H in H_3PO_4 slightly lowers the frequencies, but in addition a new line appears, which cannot be accounted for. The influence of concn. and (in conc. solution) of the cation on the frequencies in the spectra of the salts, and, in comparing the spectra of the HPO_4'' and H_2PO_4' ions, the influence of H-bonding and hydration, are discussed. The work of Venkateswaran (A., 1936, 547) is criticised. The Raman spectroscopic results, and also the high η and the chemical behaviour of anhyd. H_3PO_4, are accounted for in terms of the view that H_3PO_4 is intermediate between the aci- and pseudo-forms, the former predominating, and that H-bonding both within the mol. and between different mols. occurs. The energy of the P–O linkage is $\sim$138 kg.-cal. F. J. G.

Rule of co-ordination valency. R. F. ROBEY (J. Chem. Educ., 1939, **11**, 514—516).—The apparent generalisation that atoms and their simple ions tend to gain electrons by co-ordinating other atoms, ions, mols., or groups and thus accomplish or approach the completion of further rare gas or other stable electronic configurations, is discussed. L. S. T.

Modern quantum mechanics and the benzene problem. V. G. ELSEN (Chem. Weekblad, 1940, **37**, 39—48).—The nature of the ethylenic linkage is discussed. D. R. D.

Determination of interatomic distances from refraction of light. II. E. KORDES (Z. physikal. Chem., 1939, **B, 44**, 327—343).—The author's relation between anionic or cationic refraction ($[R_a]$, $[R_c]$) and ionic radius (r_a, r_c) (cf. A., 1940, I, 16) is used to determine interionic distances (d) from mol. refraction ($[R_m]$) vals. for a range of cryst. inorg. compounds of various structure types, SiO_2 and B_2O_3 glasses, and halide vapours. The cation is assumed to be undeformed, and $[R_c]$ is assumed or calc. from r_c; $[R_a]$ is then obtained by difference, giving r_a. In general the calc. d, assuming contact between spherical ions, are within a few % of X-ray vals., even when deviation of $[R_m]$ from the additive val. indicates considerable ionic deformation. Such deviations are a more sensitive criterion of deformation than X-ray d vals., as mutual compensation may occur between r_a and r_c. $[R_a]$ and $[R_c]$ can be calc. if $[R_m]$ and d are known. A. J. E. W.

Calculation of force constants in some methyl compounds. J. W. LINNETT (J. Chem. Physics, 1940, **8**, 91—98).—Using potential functions based on a valency-type force field and modified by introducing a cross term suggested by physical considerations, force const. (k) calculations have been made for C_2H_6, MeF, MeCl, MeBr, MeI, MeCN, and MeNC and observed and calc. vals. of ω are compared. In the Me halides the bending const. k_{HCH} alone remains unaltered, the other four showing variation. In MeCN k_{C-C} is 5·3 whilst in C_2H_6 k_{C-C} is $4{\cdot}53 \times 10^5$ dynes cm. per radian, indicating that in MeCN the C–C linking possesses some double bond character in agreement with electron diffraction data (A., 1939, I, 306). The variation in vals. of any k common to two or more of these mols. is discussed. W. R. A.

Potential function of the plane oscillations of benzene. Calculation of the normal plane vibration frequencies of s-$C_6H_3D_3$, p-$C_6H_2D_4$, and p-$C_6H_4D_2$. E. BERNARD, C. MANNEBACK, and A. VERLEYSEN (Ann. Soc. Sci. Bruxelles, 1939, **59**, 376—402).—Mathematical. A potential function is derived and applied to C_6H_6 and C_6D_6 giving vals. in good agreement with recorded data (A., 1936, 1322). It is also compared with potential functions used by Lord and Andrews (A., 1937, I, 175) and Redlich and Stricks (A., 1936, 663, 1319). The plane vibrations of s-$C_6H_3D_3$ and of p-$C_6H_4D_2$ and p-$C_6H_2D_4$ have been calc. from the potential function on the assumption that s-$C_6H_3D_3$ has D_{3h} symmetry and the two others have V_h symmetry. W. R. A.

Dimensions of electromagnetic magnitudes. A. SOMMERFELD (Ann. Physik, 1939, [v], **36**, 335—339).—A discussion of the four- and five-dimensional systems M–L–T–Q and M–L–T–Q–P, where Q and P are respectively units of charge and pole-strength. A no. of simple relationships follow from these, *e.g.*, $\epsilon = Q^2 \times 10^{-5}$ erg $\times L^{-1}$, $\mu = 10^5$ erg $T^2Q^{-2}L^{-1} = 10^5$ erg $\times LP^{-2}$, and $\sqrt{(\epsilon\mu)} = T/L = Q/P$. L. G. G.

Evolution of the quantum-mechanical dispersion theory by the method of Laue. G. MOLIÈRE (Ann. Physik, [v], **36**, 265—274).—Theoretical. L. G. G.

Probability of electron spin reversal by collision in nitric oxide gas. H. O. KNESER (Physikal. Z., 1939, **40**, 681).—Measurements of velocity of sound give a val. for the sp. heat of NO in agreement with the static val. As the latter requires separation of the ground states, it would appear that spin reversal can take place by a collision process. L. G. G.

Chemical force as the effect of matter field. P. HUND (Ann. Physik, 1939, [v], **36**, 319—327).—Theoretical. L. G. G.

Stability of polymorphous forms of normal hydrocarbons with long stretched chains and their derivatives.—See A., 1940, II, 61.

Statistical-kinetic theory, thermodynamics and biological importance of rubber-like elasticity. E. WÖHLISCH (Kolloid-Z., 1939, **89**, 239—271).—A general review. F. L. U.

Atomic distribution curves for liquids. C. A. COULSON and G. S. RUSHBROOKE (Physical Rev., 1939, [ii], **56**, 1216—1223).—Mathematical. Experimental curves are interpreted on the basis of an Einstein model approximated to a liquid. A semi-empirical application of the theory to liquid Na (cf. Wall, A., 1939, I, 133) gives a latent heat of fusion in

fair agreement with theory. The model suggests a change of structure on melting. N. M. B.

Structure of liquids. J. O. HIRSCHFELDER (J. Chem. Educ., 1939, **11**, 540—544).—Eyring's theory of liquids is developed in terms of elementary thermodynamics. An equation of state, which is shown to be the limiting form of the van der Waals equation for close packing, is derived. The Hildebrand and Trouton rules for v.p., the entropy change on melting, and the temp. coeff. of η are discussed. L. S. T.

Influence of temperature on the *X*-ray interference in monatomic hexagonal crystals. M. KOHLER (Ann. Physik, 1939, [v], **36**, 227—238).—Mathematical. An expression is derived for the influence of motion due to heat on the intensity of *X*-ray reflexion from metallic crystals. The temp. factor in hexagonal crystals $\propto$ the angle between the normal to the reflecting plane and the hexagonal axis. Use of the simple Debye expression, at higher temp., leads to incorrect results. L. G. G.

Propagation surface of scalar waves in a lattice-like medium. E. FUES (Ann. Physik, 1939, [v], **36**, 209—226).—A theoretical examination of wave motion in a cryst. medium. L. G. G.

Indirect excitation of *X*-ray interference. E. LAMLA (Ann. Physik, 1939, [v], **36**, 194—208).—Mathematical. L. G. G.

Space lattice interference and resonance processes. W. KOSSEL (Ann. Physik, 1939, [v], **36**, 189—193).—Theoretical. L. G. G.

Reciprocal lattice of crystals. W. F. DE JONG and J. BOUMAN (Natuurwetensch. Tijds., 1939, **21**, 291—303).—The mathematical basis is discussed. S. C.

Wooden balls for [molecular] structure models. P. TERPSTRA (Natuurwetensch. Tijds., 1939, **21**, 284—290).—Various methods of making models are discussed. S. C.

Vitrification of water. B. J. LUYET (Physical Rev., 1939, [ii], **56**, 1244).—The cooling by liquid air of sprayed or deposited H_2O droplets being insufficiently rapid, amorphous solid H_2O was obtained by flattening traces of liquid H_2O between two metal plates, cooled in liquid air, one of which was projected at high speed towards the other. The film of H_2O caught between the two plates from a 1-mm. stream undergoes vitrification. N. M. B.

Diffraction of *X*-rays by liquid and plastic sulphur. N. S. GINGRICH (J. Chem. Physics, 1940, **8**, 29—32).—*X*-Ray diffraction patterns of plastic S (I) at room temp., and of liquid S (II) at temp. from 124° to 340° have been examined. For (II), the position of the main diffraction peak alters irregularly with temp. The at. distribution curves of (I) and (II) at 124°, 166°, 175°, 225°, and 340° are similar. The nearest neighbours are found at 2·08 A. (I), and at ~2·07 A. for (II) at all temp., whilst the no. of nearest neighbours is 2·0 for (I) and ~1·7 for (II). An attempted explanation of certain properties of S on the basis of these data is made and it is concluded that (i) there is no measurable alteration of the first interat. distance with temp. (from 124° to 340°), and (ii) (II) is not a close-packed liquid such as Na or Hg but one in which most atoms still have two permanent neighbours which are covalently linked at the same distance as in the S_8 mol. W. R. A.

Fibre structure in alkali metal wires. C. GORIA (Kolloid-Z., 1939, **89**, 325—328).—Whilst rapid solidification of molten Na, K, and K–Rb alloy (K 55%) gives small disordered crystals, slow cooling promotes a fibrous structure with the fibre axis parallel with (001). Pressure and stretching cause the fibre axis to be parallel with (111) and (110), respectively. The alkali metals possess the same lattice at room temp. as at very low temp. F. L. U.

Lattice of the high-temperature form of potassium hydroxide. W. TEICHERT and W. KLEMM (Z. anorg. Chem., 1939, **243**, 138—144).—High-temp. KOH has the NaCl structure with *a* 5·78 A., from which the ionic radius of OH′ is 1·53 A. F. J. G.

Crystal structure of tetraphosphonitrile chloride. J. A. A. KETELAAR and T. A. DE VRIES (Rec. trav. chim., 1939, **58**, 1081—1099).—The crystal structure of $P_4N_4Cl_8$ has been completely determined by means of Patterson and Fourier analysis. The tetragonal unit cell has *a* 10·82, *c* 5·95 A., and contains two mols. At. parameters and interat. distances are given. The space-group is C_{4h}^4. The mol. is an eight-membered ring of alternating N and P atoms, each P carrying two Cl, and having an approx. tetrahedral arrangement of its four linkings. The P—N distances are all ~1·67 A., as against 1·8 and 1·6 A. to be expected for single and double linkings, respectively, so that an " aromatic " structure is indicated. F. J. G.

Unit cell of the crystals of *p*-aminobenzoic acid. M. PRASAD, M. R. KAPADIA, and V. C. THAKAR (J. Univ. Bombay, 1939, **8**, Part 3, 123—125).—Measurement of the crystallographic unit cell (A., 1938, I, 180) involves the siting of a mol. at the centre of the *a*–*c* face which is usually disallowed in monoclinic crystals. The revised dimensions of the unit cell are *a* 12·76, *b* 8·61, *c* 6·30 A., β 108° 54′. F. R. G.

Crystal structure of acid compounds of graphite. W. RÜDORFF (Z. physikal. Chem., 1939, **B**, **45**, 42—68; cf. A., 1938, I, 410).—*X*-Ray investigations show that the oxidation of graphite by conc. inorg. acids occurs in discontinuous steps during which the crystals are split into thinner and thinner laminæ until graphite and acid ions are arranged in alternate layers in the crystal lattice. The last five stages of this oxidation have been recognised by the change in the *c* axis of the crystal. The arrangement of the acid ions in the final oxidation product is discussed. J. W. S.

X-Ray measurements on wet insulin crystals. (MISS) D. CROWFOOT and D. RILEY (Nature, 1939, **144**, 1011—1012).—*X*-Ray photographs of crystals of Zn insulin in different mother-liquors show that the wet-crystal unit cell is a moderately expanded form of that found for air-dried crystals. For the wet crystals ρ is 1·276—1·283, and the calc. mol. wt. 52,400. Preliminary Patterson projections on the

basal plane (0001) indicate that the marked difference in intensities of the *X*-ray reflexions shown by the dry and wet crystals is to be correlated mainly with a re-orientation of the mols. that occurs on drying.

L. S. T.

Lattice of rubber. L. C. MISCH and A. J. A. VAN DER WYK (J. Chem. Physics, 1940, **8**, 127).—A Weissenberg picture of a piece of latex film with good higher orientation shows the splitting of A_2, the equator reflexion, into two reflexions of equal intensity and shape, the angle between the two max. being 39·2°; the lattice is pseudorhombic. The smallest cell consistent with diffraction data is, in monoclinic parameters, *a* 8·97, *b* 8·20, *c* 26·7 A., β 70·4°. The cell contains 16 isoprene units (8 chains); calc. ρ = 0·97 in accord with 0·965, the highest measured val. for stretched rubber. The cell is not, however, satisfactory; it seems too large, and ~90% of the spectra are missing. A smaller unit cell can exist only if there are several structures present simultaneously. All reflexions in the Weissenberg picture would be explained by two unit cells: M_2, monoclinic, *a* 8·97, *b* 8·20, *c* 6·68 A., β 70·4°, containing two chains, and T_1, triclinic, *a* 6·12, *b* 8·20, *c* 6·99 A., β 64·1°, γ 47·3°, containing one chain. W. R. A.

Fourier analysis of electron diffraction photographs. P. DEBYE (Physikal. Z., 1939, **40**, 573—577).—The method of radial distribution put forward by Pauling *et al.* (A., 1936, 272) for obtaining a Fourier analysis from electron diffraction photographs has been criticised by Rouault (A., 1939, I, 359) on the ground that the integration involved is not convergent. It is now shown that no convergence difficulties arise with the process and that the method proposed by Rouault (*loc. cit.*) is not satisfactory.

A. J. M.

Electron interference in convergent bundles. W. KOSSEL and G. MÖLLENSTEDT (Ann. Physik, 1939, [v], **36**, 113—140; cf. A., 1938, I, 606).—A convergent bundle of electrons has been used with very thin single crystals, instead of the usual parallel beam. In addition to the reflexions usually observed, a system of parallel interference bands was found. These can be used to investigate the propagation of electron waves in crystals. A. J. M.

Cause of spot abundance in electron photographs of etched crystals. G. MENZER (Ann. Physik, 1939, [v], **36**, 239—248).—The greater abundance of diffraction spots in electron diffraction photographs as compared with the *X*-ray analogues is due to the mosaic structure of the diffracting layer in the crystal. L. G. G.

Electron optics (electron lens with inter-grid, electron mirror, immersion lens). J. PICHT (Ann. Physik, 1939, [v], **36**, 249—264).—A mathematical derivation of the principal optical properties of the above. L. G. G.

Internuclear distances in Se_2, Te_2, and HgCl by electron diffraction. L. R. MAXWELL and V. M. MOSLEY (Physical Rev., 1940, [ii], **57**, 21—23).—Using the electron diffraction method for the gaseous mols., the internuclear distances found were 2·19 ± 0·03 for Se_2, 2·59 ± 0·02 for Te_2, and the Hg_2Cl separation distance 2·23 ± 0·03 A. Photographs for $HgCl_2$ indicate an Hg–Cl separation of 2·27 ± 0·03 A. Band spectrum data for Se_2 and Te_2 internuclear distances are compared. N. M. B.

Electron diffraction examination of oxide films on light metals. I. IITAKA and S. YAMAGUCHI (Nature, 1939, **144**, 1090—1091).—Electron diffraction photographs of Mg surfaces, prepared by polishing with sand paper, and exposing to air, show that, even at room temp., Mg is covered by a very thin film of MgO. This film is still thin after heating the surface in air at 400°. The surface of Al at room temp. is covered with a film of γ-Al_2O_3; that heated at 500° is covered with one of α-Al_2O_3. At room temp., Be shows no trace of a film of BeO.

L. S. T.

Molecular structures of sulphuryl fluoride and thiophosphoryl fluoride. D. P. STEVENSON and H. RUSSELL, jun. (J. Amer. Chem. Soc., 1939, **61**, 3264—3268).—From electron diffraction diagrams of SO_2F_2 (I) and PSF_3 (II) the interat. distances and bond angles are: S—F = 1·56 ± 0·02 (I); S—O = 1·43 ± 0·02 (I); P—F = 1·51 ± 0·02 (II); P—S = 1·85 ± 0·02 A. (II); angle F–S–O = 105 ± 2° (I); F–S–F = 100 ± 10° (I); F–P–F = 99·5 ± 2° (II); F–P–S = 118 ± 2°. A decrease from the normal val. of 0·09 A. in the P—S distance and a small F–P–F angle in (II) have been observed. The first difference is explained by the various resonating valency bond structures which may be written for such a mol.

W. R. A.

Molecular structure of glyoxal and dimethylglyoxal by the electron diffraction method. J. E. LUVALLE and V. SCHOMAKER (J. Amer. Chem. Soc., 1939, **61**, 3520—3525).—From electron diffraction photographs of $(CHO)_2$ (I) and $(CMeO)_2$ (II) C—H = 1·09 A. (assumed); C=O = 1·20 ± 0·01 (I), 1·20 ± 0·02 A. (II); C—C = 1·47 ± 0·02 A. (I); C_1—C_2 = 1·54 ± 0·02 A. (II); C_2—C_3 = 1·47 ± 0·02 A. (II); angle C–C=O = 123 ± 2° (I); angle CO–C=O = 123 ± 2° (II); angle Me–C=O = 122·5 ± 1° (II). Electron diffraction data, dipole moment data, and chemical information indicate that both (I) and (II) are co-planar with the *trans* configuration, and that rotation about the C-C bond connecting the adjacent CO groups is restricted. The electron diffraction data are not incompatible with a mixture containing a small fraction of *cis* mols. in (II). W. R. A.

Investigation of *spiro*pentane with cathode ray interferences.—See A., 1940, II, 72.

Elastic, dielectric, and piezoelectric constants of heavy-water Rochelle salt. A. N. HOLDEN and W. P. MASON (Physical Rev., 1940, [ii], **57**, 54—56; cf. A., 1939, I, 553).—Crystallisation of Rochelle salt from D_2O raises the upper Curie point by 11° and lowers the lower point by 5°, but leaves the other properties substantially unchanged.

N. M. B.

Ferromagnetic anisotropy. (A) **Dependence on field strength.** (B) **Iron and iron-rich silicon alloys.** (C) **Low-nickel alloys of iron.** L. P. TARASOV (Physical Rev., 1939, [ii], **56**, 1224—1230, 1231—1240, 1245—1246).—(A) In calculating anisotropy consts. from torque data, it is shown, using a

torquemeter of very high sensitivity, that a saturation val. of the torque cannot be obtained experimentally but can be calc. by extrapolating to $1/H = 0$. It is concluded that there are three distinct $1/H$ laws for torque peaks: one for single crystal ellipsoids other than those of (100) or (110) orientations, one for these (100) and (110) orientations, and one for discs.

(B) The ferromagnetic anisotropy const. K_1 was accurately measured by the magnetic torque method for Fe alloys containing up to 13·7 at.-% Si. The points fall on two intersecting straight lines for which equations are given. The val. for Fe due to Akulov is too low and is unreliable. There is a large discrepancy between vals. of K_1 calc. from Pietz's magnetisation curve measurements for an Fe ellipsoid (cf. A., 1937, I, 120) and from torque measurements on the identical specimen. An attempt is made to relate the change of slope in the K_1–at.-% Si curve with a superlattice change.

(C) Using cold-rolled material, vals. of K_1 for 0—20 at.-% Ni alloys of Fe were determined. The probable accuracy of results depends on the constancy of the texture factor (ratio of the average of the torque peaks of the polycryst. material to that of the single crystal). N. M. B.

Optical absorption of superconducting layers of tin. R. Hilsch (Physikal. Z., 1939, **40**, 592—594).—There is no change in the optical transmissibility of thin Sn layers over the spectral range 380—900 mμ., on transition from the normal to the superconducting state. Colloidal Pb and Tl dispersed in KCl crystals show a slight change in optical absorption on cooling from room temp. to −180°, but on further cooling to 2° K. there is no change in the spectrum over the range 380—700 mμ. A. J. M.

Examination of coloured alkali halides for photo-electric Hall effect. J. Evans (Physical Rev., 1940, [ii], **57**, 47—53).—Examination of NaCl, NaBr, KCl, KBr, and KI, additively coloured by electron impregnation at 500—700°, by a single cross-electrode set-up and by Tartakovsky's divided electrode method gave consistently null results. From the upper limit assigned to the Hall effect, it was computed that the mean free path of photo-electrons in rock-salt is $\gg$ the dimensions of a lattice cell. This agrees with von Hippel's result based on electrical breakdown experiments. This interpretation of the null result was supported by the absence of Hall effect for the large initial surge of electron current in KCl and KBr at the outset of illumination. No magnetic deflexion of photo-electric current in rock-salt was found for additively or photochemically coloured specimens. N. M. B.

Interferometry. IV. Detection of ageing phenomena in melts. K. Schaum (Z. wiss. Phot., 1939, **38**, 113—125; cf. A., 1926, 914).—In explanation of the phenomena by which the pre-history (*e.g.*, long heating at high temp.) of a given liquid substance or solution (*e.g.*, $COPh_2$) affects the properties of the cryst. form obtained on cooling, or the properties of the supercooled solution, etc., a theory is developed of "crystal lattice fragments" formed by mols. in the melt, and tending towards a particular behaviour (*e.g.*, rendering one crystal form the stable one); on prolonged heating these lattice fragments will be irreversibly dissociated. J. L.

Shear constants of hexagonal crystals. H. B. Huntington (Physical Rev., 1940, [ii], **57**, 60).—Mathematical. Taking account of the increase of electrostatic energy, and of ionic core repulsion energy, with distortion, calc. elastic data are tabulated for the nearly close-packed hexagonal crystals of Mg, Cu, and Zn. Since the free electron model is not applicable results show wide divergence from observed vals. N. M. B.

Polymorphism of benzophenone. K. Schaum (Annalen, 1939, **542**, 77—90; cf. A., 1928, 824 and previous abstracts).—The available experimental data are discussed and considered inadequate to establish a definite classification of the polymorphism of $COPh_2$. F. L. U.

Transformations of *n*-tricosanoic acid in the solid state.—See A., 1940, II, 64.

Cathode sputtering in a magnetic field. F. M. Penning and J. H. A. Moubis (Proc. K. Akad. Wetensch. Amsterdam, 1940, **43**, 41—56).—Sputtering in a glow discharge can be obtained at much lower pressures and higher c.d. by applying a magnetic field coaxial with a cylindrical cathode. Data are recorded for the sputtering coeff. (no. of metal atoms liberated per ion) and the sputtering efficiency ε, for Al, Cu, Ni, and Ag in A. ε is ~1%. L. J. J.

Landau diamagnetism and the Fermi–Dirac energy distribution of the metallic electrons in graphite. K. S. Krishnan (Nature, 1940, **145**, 31—32).—The abnormal diamagnetism of graphite along its hexagonal axis is the same as the Landau diamagnetism of the Fermi electron gas containing one electron per C and having a degeneracy temp. of 520° K. L. S. T.

Magnetochemical studies. III. Nitrosyl chloride and its compounds with inorganic chlorides. R. W. Asmusson (Z. anorg. Chem., 1939, **243**, 127—137).—χ vals. for a no. of additive compounds of NOCl with inorg. chlorides are recorded. They bear out the classification of these compounds on chemical grounds, and indicate that NOCl itself must be diamagnetic. This, and the resemblance in physical properties between NOCl and SO_2, are in accordance with resonance between the structures $Cl^-(NO)^+$, Cl–N=O, and $Cl \rightleftharpoons N \rightarrow O$. The compound formulated by van Heteren (A., 1900, ii, 137) as $SbCl_5,2NOCl$ is $SbCl_5,NOCl$. F. J. G.

Reactions of chromates at high temperatures. XII. Magnetic properties of chromium chromates. D. S. Datar and S. K. K. Jatkar (J. Indian Inst. Sci., 1939, **22**, **A**, 309—315).—Vals. of χ are calc. for various intermediate oxides of Cr on the basis of their formulation with Cr^{III} and Cr^{VI} (cf. A., 1940, I, 128) and compared with published data. F. J. G.

Ferrous salts of oximinoketones and their magnetic behaviour. G. Jacini (Gazzetta, 1939, **69**, 714—717; cf. A., 1934, 241).—Fe^{II} salts of oximinoketones of the type $Fe[R'\cdot CO\cdot CR''\cdot NO]_2$ give

vals. of $\mu_{eff.}$ between 3·30 and 2·92 (R′ and R″ = alkyl or aryl). Salts of the type $K[Fe^{II}(R'\cdot CO\cdot CR''\cdot NO)_3]$ are weakly paramagnetic with $\mu_{eff.}$ between 0·59 and 0·75. O. J. W.

Paramagnetic hysteresis. H. N. V. TEMPERLEY (Proc. Camb. Phil. Soc., 1940, **36**, 79—83).—Theoretical. L. J. J.

Paramagnetic dispersion. P. TEUNISSEN and C. J. GORTER (Physica, 1940, **7**, 33—44).—Magnetic inhibition of paramagnetic susceptibility at frequencies $\not> 3\cdot82 \times 10^6$ Hz., a const. field of 3200 oersted, and temp. $\not<$ 64·4° K. has been found with $V(NH_4)_2(SO_4)_2,6H_2O$, Cr K alum, $Cr(NO_3)_3,9H_2O$, $Mn(NH_4)_2(SO_4)_2,6H_2O$, $MnSO_4,4H_2O$, $MnCl_2,4H_2O$, Fe NH_4 alum, and $Fe(NO_3)_3,9H_2O$. The $Mn^{\cdot\cdot}$ salts show the effect at room temp. Data are recorded. No effect is found with $Mn^{\cdot\cdot}$ solutions at room temp. L. J. J.

Magnetic properties of some salts of the iron group at low temperatures. W. J. DE HAAS, B. H. SCHULTZ, and (MISS) J. KOOLHAAS (Physica, 1940, **7**, 57—69).—The author's earlier work (A., 1939, I, 408) is extended to $MnSO_4$, MnI_2, MnF_2, $MnBr_2$, $NiCl_2$, NiF_2, $Cr_2(SO_4)_3$, $CrCl_3$, CuF_2, and $CuSO_4$. L. J. J.

Paramagnetic relaxation in iron ammonium alum and chromium potassium alum. F. K. DU PRÉ (Physica, 1940, **7**, 79—91).—The mutual inductance bridge method (cf. A., 1939, I, 514) has been used to determine the differential susceptibility of Fe NH_4 and Cr K alums at 1—4° K. in external fields up to 1820 gauss. The results are in agreement with theory (A., 1938, I, 391). Fe NH_4 alum gives $(1110\pm25) \times 10^3 T^{-2}$ erg per g. ion per degree for the sp. heat of the spin system, 0·185°±0·004° K. for the overall splitting of the lowest level of $Fe^{\cdot\cdot\cdot}$ by the crystal field, and $3\cdot5 \times 10^{-3}$ sec. for the relaxation time in a field of 1350 gauss. For Cr K alum the corresponding vals. are $(1500\pm25) \times 10^3 T^{-2}$ erg per g. ion per degree, 0·260°±0·005° K., and 7×10^{-3} sec., respectively. L. J. J.

Theory of paramagnetic relaxation. H. DÄNZER (Physikal. Z., 1939, **40**, 557—559).—Casimir *et al.* (A., 1938, I, 391) have shown that the occurrence of paramagnetic relaxation with certain crystals can be explained by assuming that a temp. difference can exist between the system of elementary magnets in the magnetic field and the crystal lattice in which the paramagnetic ions are situated. The theory giving the relaxation time is developed on the basis of this explanation and the theory of Krönig (cf. A., 1938, I, 391). A. J. M.

Retardation of magnetisation through microscopic eddy currents. R. BECKER (Ann. Physik, 1939, [v], **36**, 340—348).—A quant. explanation of the absence of ferromagnetic susceptibility at high frequencies. L. G. G.

Validity of the Curie law for oxygen at high density. M. KANZLER (Ann. Physik, 1939, [v], **36**, 38—46; cf. Lues, A., 1936, 416).—Apparatus for the precision measurement of the variation of the susceptibility of O_2 with temp. and pressure is described. At temp. between 290° and ~625° K. and densities up to d^{20} 0·12, the χT = const. law is obeyed within 1%. At the same temp. and densities $>d^{20}$ 0·2, the law $\chi(T - \Theta)$ = const. is obeyed; Θ has increasing negative vals. with increasing *d*. O. D. S.

Electrical conductivity of the alkali metals in a magnetic field. E. JUSTI and M. KOHLER (Ann. Physik, 1939, [v], **36**, 349—356).—Measurements of the electrical resistance of pure Na under the influence of longitudinal and transverse magnetic fields up to 35,000 gauss and over the range room temp. to 14° K. have been made. The increase in resistance with increase in field is slow and approx. the same for transversely and longitudinally applied fields. The change in resistance is ascribed to anisotropy of the electron collision times. L. G. G.

Thermal resistance of pure beryllium crystals and its variation in a transverse magnetic field. E. GRÜNEISEN and H. D. ERFLING (Ann. Physik, 1939, [v], **36**, 357—367; cf. A., 1938, I, 302).—The resistance of hexagonal Be (c/a = 1·568) has been measured over the temp. range 20° to −250° and in both of the principal directions, in relation to the direction and strength of transverse magnetic fields. Results are generally similar to those obtained with Bi. L. G. G.

Conductivity and mobility of thin lead films. M. G. FOSTER (Physical Rev., 1940, [ii], **57**, 42—46; cf. Mitchell, A., 1938, I, 176).—Electrical conductivity measurements on thin Pb films condensed in high vac. on cooled glass surfaces at rates 5×10^{12}—100×10^{12} atoms per sec. per sq. cm. show that the crit. film thickness at which the sp. conductivity begins changing rapidly from its low val. in the thinnest films to that of the bulk metal is ~60 A. for room temp. films and ~30 A. for films cooled with liquid air. The mutual configuration of the condensed Pb atoms is unstable and changes with time, as shown by decreased conductivity of the isolated film, and in the eventual appearance of a granular structure visible under the ultramicroscope. These effects accord with the mechanism expected from thermodynamic stability considerations. N. M. B.

Properties of some superconductors. D. SHOENBERG (Proc. Camb. Phil. Soc., 1940, **36**, 84—93).—Crit. field–temp. curves of pure Al, Ga, Th, and Zn have been determined. Al and to a much smaller extent Ga show a supercooling effect when either the temp. or the field is reduced below the crit. val. Al, Ga, and Th have "pure" superconducting properties. Pure Ti down to 1·0° K., pure Mo down to 0·3°, and pure U down to 0·98° K. did not show superconductivity. L. J. J.

Thermodynamic and kinetic treatment of the thermo-electric effects in magnetic field. J. MEIXNER (Ann. Physik, 1939, [v], **35**, 701—734; cf. A., 1939, I, 65).—Mathematical. The validity of the second Thomson relation between thermo-electric consts. is discussed. It is shown that the thermo-electric effects are not reversible in the presence of magnetic field. Expressions for the variation of the thermo-electric consts., and of the consts. for the galvanomagnetic and thermomagnetic transversal

effects, with temp. and magnetic field are deduced and agree with experimental data. O. D. S.

Effect of reversal of magnetic field on the galvanomagnetic and thermomagnetic effects. J. Meixner (Ann. Physik, 1939, [v], **36**, 105—112).—Theoretical considerations lead to the conclusion that the resistance of a conductor in a magnetic field should, under certain conditions of crystal symmetry, vary when the field is reversed. No effect should be observed with isotropic substances. Similar results should be found with the thermomagnetic effect. At present the effect, in the case of resistance, has not been observed experimentally, and reasons for this are given. The reversal effect has, however, been observed with thermo-electric power (Grüneisen *et al.*, A., 1936, 930, 1329). A. J. M.

Relationships between velocity of sound in, and constitution of, organic compounds. W. Schaaffs (Z. Physik, 1939, **114**, 251—256; cf. A., 1940, I, 65).—The vals. of b derived by the method previously described are shown to exhibit additivity in a manner similar to at. and mol. refraction. L. G. G.

Sound velocity and intermolecular forces. M. R. Rao (Current Sci., 1939, **8**, 510—511).—From a study of the variation of sound velocity with temp. in C_6H_6 (10—50°) and PhMe (0—50°), $(1/v)[(dv/d\theta)/(1/V)](dV/d\theta) = -3{\cdot}03$, where v = velocity of sound in the liquid at temp. θ, and V = mol. vol. of the liquid at that temp. Integrating, $vV^{3\cdot03}$ = const., and $v^{0\cdot33}V$ = const. (R). For C_6H_6 and PhMe $R \simeq 952$ and 1141 respectively. Vals. of R for CCl_4, PhCl, Pr^aOAc, $EtCO_2Et$, C_7H_{16}, and C_8H_{18} are recorded. The ratio of R to the crit. vol. $V_c \simeq 3{\cdot}53$ for all substances. Thus $v \propto$ the ninth power of the distance between the mols. W. R. A.

Absorption of ultrasonic waves in mercury. P. Rieckmann (Physikal. Z., 1939, **40**, 582—590).—A method for determining the absorption of ultrasonic waves in liquid Hg is described. In the range of frequencies 21·5—54 mHz., $\alpha/\nu^2 = 1{\cdot}30 \times 10^{-16}$ (α is absorption coeff., ν is frequency), whereas the theoretical val. for Hg is $1{\cdot}03 \times 10^{-16}$. A. J. M.

Supersonic effects of water vapour in carbon dioxide and their relation to molecular vibrations. W. H. Pielemeier, H. L. Saxton, and D. Telfair (J. Chem. Physics, 1940, **8**, 106—115).—The velocity and absorption of supersonic waves in CO_2 have been computed from acoustic interferometer measurements at ~28° and atm. pressure. Various H_2O vapour concns. were used with each frequency employed (284 to 1595 kc. per sec.). At each frequency the absorption per λ rises with increasing concn. of H_2O vapour to a max. of ~0·28 and then falls slowly; at lower frequencies it passes through a shelf or minor peak before saturation is attained. As the absorption peak is approached the velocity drops ~10 m. per sec., and a drop of 1 m. per sec. occurs similarly near the minor peak. As the frequency is increased, the crit. concn. of H_2O vapour is also increased. Equations are given relating the frequency with the H_2O vapour concn. for the two peaks, which show that the average life-time of a $h\nu$ of vibrational energy decreases more rapidly with increased humidity. The data are represented accurately by theory. W. R. A.

Heat tonality of the "paramagnetic Curie temperature" of vanadium dioxide. W. Klemm and L. Grimm (Naturwiss., 1939, **27**, 787).—If VO_2 possesses a paramagnetic Curie temp. there should be a heat tonality such as occurs with ferromagnetic substances. This has been observed, the vals. being $VO_{1\cdot9}$ —1·1, VO_2 —0·8, $VO_{2\cdot1}$ —1·1 kg.-cal. per mol., and of the expected order. The paramagnetic Curie point is thus completely analogous to the ferromagnetic Curie point as regards thermal behaviour. A. J. M.

Influence of ionisation and dissociation on specific heat. F. Möglich, K. H. Riewe, and R. Rompe (Ann. Physik, 1939, [v], **35**, 735—760).—Theoretical. The mol. sp. heat of a partly dissociated or ionised gas is calc., and the processes $H_2 \rightarrow 2H$, $H \rightarrow H^+$, and the first four steps in the ionisation of Hg are discussed. A max. sp. heat occurs at about 0·5 dissociation or ionisation in each case. The position and height of the max. are dependent on pressure. A similar max. sp. heat is predicted for the electron gas of a semi-conductor. O. D. S.

Specific heat of some ethylene halides. W. E. Railing (J. Amer. Chem. Soc., 1939, **61**, 3349—3353).—The heat capacities of $(CH_2Cl)_2$, $(CH_2Br)_2$, and C_2H_4ClBr have been determined from 90° to 320° K. by the method of Stull (A., 1938, I, 99). The heats of fusion and transition of the three compounds are respectively 2090 (—35·5°), 680; 2300 (—16·7°), 740; 2590 (9·93°), 450 (—22·5°) g.-cal. per mol. Assuming that a configuration of min. energy exists in addition to the *trans* configuration it is concluded that an equilibrium between *cis* and *trans* isomerides exists and that the liquid state contains a considerable amount and the solid state practically none of the *cis* isomeride. Rapid freezing, however, leads to an appreciable amount of *cis* isomeride being frozen in because the time for complete transformation into the *trans* form is insufficient. The influence of rapid melting is also considered from the viewpoint of intramol. rotation. W. R. A.

Entropy of dimethylacetylene from low-temperature calorimetric measurements. Free rotation in the dimethylacetylene molecule. D. W. Osborne, C. S. Garner, and D. M. Yost (J. Chem. Physics, 1940, **8**, 131).—The separation of Me groups in C_2Me_2 is $\gg$ the corresponding separation in C_2H_6. C_2H_6 has a potential barrier of ~3000 g.-cal. per mol. restricting free rotation which may arise (*a*) from interaction of Me groups or (*b*) from resonance. If it is cause (*a*) the restricting potential in C_2Me_2 should be $<$, but if cause (*b*) $\simeq$, that for C_2H_6. Using an adiabatic calorimeter, heat capacities have been determined from 14° to 291° K. The heats of fusion and vaporisation are respectively: 2206·7 (at 240·93° K.) and 6440 (at 291·00° K./536 mm.) g.-cal. per mol. The entropy of the actual gas at 291° K. and 536 mm. is 68·00±0·1 g.-cal. per degree per mol. Assuming that the gas has a crit. temp. of 489° K. and a crit. pressure of 41 atm. and that it obeys a Berthelot equation of state, the entropy is 68·14 g.-cal. per

degree per mol. in fair agreement with the val. (67·82) derived from spectroscopic data. Causes of the deviation are discussed. It is concluded, in agreement with Crawford and Rice (A., 1939, I, 409), that a restricting barrier is absent. W. R. A.

Born's thermodynamic theory of melting. L. BALAMUTH (J. Chem. Physics, 1940, **8**, 127—128).—Comments on Born's paper (A., 1939, I, 552). W. R. A.

Freezing points of pure high polymers. E. L. LOVELL and H. HIBBERT (J. Amer. Chem. Soc., 1940, **62**, 230—231).—The empirical relation for the setting points of the polyoxyethylene glycols (cf. A., 1939, II, 402) is identical with that of Huggins (A., 1940, I, 64), which was derived thermodynamically. W. R. A.

Calculation of the b.p. of simple compounds. J. M. STEVELS (Natuurwetensch. Tijds., 1939, **21**, 256—262).—The calculation of b.p. of simple halogenated methanes and ethanes, silanes, and germanes from the London, Debye, and Keesom effects is discussed. S. C.

Density, thermal expansion, vapour pressure, and refractive index of styrene, and the density and thermal expansion of polystyrene. W. PATNODE and W. J. SCHEIBER (J. Amer. Chem. Soc., 1939, **61**, 3449—3451).—Data are recorded for the ρ and thermal expansion of styrene (I) and polystyrene (II), and the v.p. and n of (I). For (I), $\rho^{\theta} = 0·9240 - 0·000918\theta$ ($\theta = 30—120°$), $\log p = -1649·6/(\theta + 230) + 7·2788$, $n_D^{\theta} = 1·5583 - 0·000560$. The plot of ρ of resinous (II) against temp. consists of two straight lines, the point of intersection of which corresponds apparently with a fundamental change in the structure of the polymeride. The thermal expansion of the polymeride is also bi-linear. W. R. A.

Vapour pressure and volatility of some war gases. E. O. K. VERSTRAETE (Natuurwetensch. Tijds., 1939, **21**, 205—214).—The following data for b.p./760°, p_{20} and volatility in mg./m.^{3} at 20° are recorded from the most reliable data in the literature: Cl_2 (—33·6°, 5·031, 20×10^6), $COCl_2$ (8·2°, 1·082, 6×10^6), $ClCO_2CCl_3$ (128°, 10·3, 111,500), mustard gas (216°, 0·115, 1000), lewisite (190°, 0·426, 4840), $CCl_3·NO_2$ (111°, 18·2, 164,000), CH_2PhBr (198°, 0·50, 4680), $C_6H_4Me·CH_2Br$ (213°, 0·07, 707), CHPhBr·CN (242°, 0·012, 130), $COMe·CH_2Br$ (136·5°, 6·03, 45,150), $COMe·CH_2Cl$ (119°, 13·2, 66,790), $COPh·CH_2Cl$ (247°, 0·013, 110), $AsPh_2Cl$ (333°, 0·0005, 7·25), $AsPh_2·CN$ (360°, 10^{-5}, 0·16), $NH(C_6H_4)_2AsCl$ (410°, 2 × 10^{-6}, 0·03). S. C.

Thermodynamic properties of hexyl alcohols. III. β-Methylpentan-γ-ol and γ-methylpentan-γ-ol. F. HOVORKA, H. P. LANKELMA, and A. E. AXELROD (J. Amer. Chem. Soc., 1940, **62**, 187—189; cf. A., 1938, I, 304).—The v.p. of CHEtPr$^{\beta}$·OH and $CMeEt_2·OH$ have been measured from 25° to 125°; the observed vals. agree with those calc. from the Rankine equation. The vals. of Trouton's const. are >21, indicating association. The heats of vaporisation and b.p. have been derived from v.p. data. Vals. of γ, η, ρ, n, parachor, Eötvös const., total surface energy, and crit. const. are recorded and discussed. W. R. A.

Thermodynamic properties from P–V–T data. R. YORK (Ind. Eng. Chem., 1940, **32**, 54—56).—Theoretical. Using a method of residuals and taking advantage of the approx. linear relation existing between P and T along the isometric of a gas, evaluations of isothermal changes in internal and free energy, enthalpy, and entropy can be made. C. R. H.

Dissociation treatment of condensing systems. III. Properties of saturated vapours of H_2O, NH_3, MeCl, and CO_2. T. P. TSENG, S. K. FENG, C. CHENG, and W. BAND (J. Chem. Physics, 1940, **8**, 20—23; cf. A., 1940, I, 18).—The simpler equation (A., 1939, I, 358) in the dissociation treatment of condensing systems applied to the vapours of H_2O, NH_3, MeCl, and CO_2 satisfactorily represents the saturated v.p. curves at temp. not near to the crit. points. Curves are given for PV/NkT and for surface energy. An appreciable discrepancy in the energy curves for H_2O at low vals. of T/T_c may be removed by considering the small size of the clusters involved in the equilibrium between vapour and liquid; the surface energy in a cluster may differ from that for the liquid in bulk. A method of estimating mean cluster sizes is suggested; it leads to reasonable results. W. R. A.

Gas kinetic processes in an expansion cylinder. W. MEISSNER and G. MEISSNER (Ann. Physik, 1939, [v], **36**, 303—318).—Theoretical. L. G. G.

The second law [of thermodynamics] and the difference between past and future. C. F. VON WEIZSÄCKER (Ann. Physik, 1939, [v], **36**, 275—283).—Philosophical. L. G. G.

Propagation of heat in liquid He II. E. GANZ (Proc. Camb. Phil. Soc., 1940, **36**, 127—130; cf. A., 1939, I, 604).—Thermal energy is transmitted over considerable distances in liquid He II and in adsorbed films of He II a few atoms thick at a velocity of $\sim 10^4$ cm. per sec. L. J. J.

Problems in the diffraction of heat. A. N. LOWAN (Phil. Mag., 1940, [vii], **29**, 93—99).—Mathematical. L. J. J.

Viscosity of hydrogen vapour. W. H. KEESOM and P. H. KEESOM (Physica, 1940, **7**, 29—32).—Between 14° and 20·5° K., η for saturated H_2 vapour is $(0·584T - 0·55) \times 10^{-6}$ poise. L. J. J.

Viscosity of liquid hydrogen. H. E. JOHNS (Canad. J. Res., 1939, **17**, **A**, 221—226).—Vals. for η of liquid H_2 obtained by measuring its flow through fine capillaries are ~10% > vals. obtained by the oscillating disc method of Keesom and Macwood (cf. A., 1938, I, 508). The plot of log η against $1/T$ is linear over the range 17—21° K., but the slope of d log η/d $(1/T)$ decreases at lower temp. C. R. H.

Viscosity of liquid ammonia. C. J. PLANK and H. HUNT (J. Amer. Chem. Soc., 1939, **61**, 3590—3591).—The following vals. are given respectively for ρ and η (g. per cm. sec.): at 5°, 0·63197, 0·001618; at 15°, 0·61821, 0·001457; at 25°, 0·60427, 0·001350. Differences between these and the vals. of Stakelbeck (A., 1933, 1238) are discussed. W. R. A.

Influence of temperature and specific volume on the viscosity of liquids. III. W. R. VAN WIJK, J. H. VAN DER VEEN, H. C. BRINKMAN, and W. A. SEEDER (Physica, 1940, **7**, 45—56; cf. A., 1939, I, 191).—An apparatus for the measurement of η in liquids at pressures up to 1500 atm. and temp. 0—150° is described. Data for η and sp. vol. are recorded over these pressure and temp. ranges for C_3H_8, CMe_4, CCl_4, and n-$C_{18}H_{37}\cdot OH$ (I). C_3H_8 and CMe_4 give a val. of zero for the configurational energy term in the formula given previously; CCl_4 shows a slight degree of configuration, whilst (I) shows a high degree. The vol. in the closely packed condition is independent of temp. in the case of C_3H_8, and decreases with rising temp. in the case of CMe_4 and CCl_4. The large variation of the m.p. of CMe_4 with pressure makes it suitable for pressure measurements. L. J. J.

Kinetics of thermo-diffusion in liquids. K. WIRTZ (Ann. Physik, 1939, [v], **36**, 295—302; cf. A., 1939, I, 470).—Theoretical. Expressions are derived for the ratio of the thermo-diffusion const. (D') to the ordinary diffusion const. (D) based on the definition that D' is the temp. coeff. of D. L. G. G.

Thermodynamics of oxygen–nitrogen mixtures. V. FISCHER (Ann. Physik, 1939, [v], **36**, 381—396).—Theoretical. The equilibrium isotherms and isobars of the mixtures are considered. A. J. M.

B.p. of system formic acid–water. S. TAKAGI (Bull. Chem. Soc. Japan, 1939, **14**, 508—509).—The b.p. of the liquid have been measured and plotted against the compositions of the vapour and liquid for pressures of 25, 49, and 252 mm. Hg and the compositions of the azeotropic mixtures distilling at 100 and 774 mm. have also been measured. An expression connecting the total v.p. and the b.p. of azeotropic mixtures is given. T. H. G.

Viscosity of mixed aqueous solutions of strong electrolytes with special reference to the theory of Onsager and Fuoss. E. ASMUS (Ann. Physik, 1939, [v], **36**, 166—182).—The relative η of mixtures of aq. solutions of $CuSO_4$ and KCl, and of $CuSO_4$ and H_2SO_4, as a function of mol. concn. and total ionic concn. at 25° has been determined. For very dil. solutions $\eta/\eta_0 = 1 + a\sqrt{I} + bI$. ($I$ = total ionic concn., η_0 = viscosity of pure solvent.) A. J. M.

Electrical conductivity, viscosity, and surface tension of the system H_2SO_4–$HClO_4$. M. USSANOVITSCH, T. SUMAROKOVA, and V. UDOVENKO (Acta Physicochim. U.R.S.S., 1939, **11**, 505—520).—An apparatus for rapid determination of κ, η, and γ for a single small sample of a liquid is described, and data on κ, η, γ, and ρ at 0°, 10°, and 25° for anhyd. H_2SO_4–$HClO_4$ mixtures are given. The isothermals of κ have a max. at 33% of H_2SO_4, but this disappears when corr. for η, and the isothermals of η, γ, and ρ have neither max. nor min. There is thus no indication of compound formation. F. J. G.

Diffusion of Creolin in water. A. H. MENDIKIAN (Bull. Acad. Sci. Roumaine, 1938, **20**, 23).—Eight photographs of the phenomena resulting during diffusion of Creolin (Pearson) in water are reproduced. F. H.

Study of diffusion processes by electrolysis with micro-electrodes. H. A. LAITINEN and I. M. KOLTHOFF (J. Amer. Chem. Soc., 1939, **61**, 3344—3349; cf. A., 1939, I, 605).—Current–time curves have been obtained with Pt micro-electrodes of various shapes and diffusion fields in the electro-oxidation of $Fe(CN)_6''''$ ions at 25° [0·001M-$K_4Fe(CN)_6$ in 0·1N-KCl; 0·00488M-$K_4Fe(CN)_6$ in 0·1N-KCl]. Theoretical conditions have not been obtained with spherically symmetrical diffusion in aq. solution, but have been approached in 3% agar and 4% gelatin gels. W. R. A.

Viscosity of solutions of sulphur dioxide in organic liquids. S. B. CUPP and H. E. ROGERS (J. Amer. Chem. Soc., 1939, **61**, 3353—3354).—The η and ρ of various solutions of SO_2 in $Pr^{\alpha}Br$, $Pr^{\beta}Br$, and $Bu^{\alpha}Br$, and the expansion in vol. ΔV on dissolution, have been measured at 25°. ΔV is positive for all, and the η of the solutions are < the vals. calc. from the η of the pure liquids. The max. val. of ΔV is almost const. for the three liquids. W. R. A.

Internal binding energy and constitution of glass. I. Viscosity of glass at temperatures near the transformation point. II. Viscosity and internal binding energy of soda–silica glasses. T. MORIYA (J. Soc. Chem. Ind. Japan, 1939, **42**, 357B, 357—358B).—I. The η of glass fibres was determined by measuring the elongation rate when under longitudinal tension. Log η plotted against $1/T$ gave two straight lines meeting at the transformation temp. (T_t).

II. From the slopes of log η–$1/T$ curves the vals. of the binding energy (E) were calc. At temp. > and < T_t, E respectively decreased and increased with increasing SiO_2 content. C. R. H.

Specific gravity of ternary glasses CaO–Na_2O–SiO_2 at high temperatures. VI—VIII. I. SAWAI and S. INOUE (J. Soc. Chem. Ind. Japan, 1939, **42**, 331—332B).—The proportion of SiO_2 and CaO in the glasses examined was respectively 70—72% and 8—13%, and d was determined over the range 25—1200°. For a given SiO_2 content, an increase in CaO generally increases d at all temp. C. R. H.

Number of configurations of an assembly with long-distance order. T. S. CHANG (Proc. Roy. Soc., 1939, **A**, **173**, 48—58).—The theory is developed for the case of an ideal alloy of A and B atoms with a lattice structure of the AB type, *i.e.*, consisting of two sublattices of α and β sites, no two points of the same sublattice being nearest neighbours. The partition function is obtained and hence an approx. expression for the no. of ways of arranging $\frac{1}{2}N(\theta + \theta')$ particles on a lattice of type AB consisting of N sites in all, $\frac{1}{2}N\theta$ particles on α sites, $\frac{1}{2}N\theta'$ on β sites, producing X pairs of nearest neighbours. G. D. P.

Behaviour of the alkali metals to one another. B. BÖHM and W. KLEMM (Z. anorg. Chem., 1939, **243**, 69—85).—Lattice consts. and magnetic properties, and in some instances equilibrium, have been studied in the binary alloys of the alkali metals. The systems Li–Rb and Li–Cs show complete immiscibility in solid and liquid. The system Rb–Cs consists

of a continuous mixed crystal series (cf. A., 1936, 559; 1937, I, 455). χ for the solid phases, whether compounds or solid solutions, is approx. additive, only slight deviations in the direction of decreased paramagnetism occurring, but larger deviations occur for the melts. The lattice consts. for the mixed crystals are very closely additive; there is only a very slight contraction even in the system Na–Cs.

F. J. G.

System copper–manganese. G. GRUBE, E. OESTREICHER, and O. WINKLER (Z. Elektrochem., 1939, **45**, 776—784).—The system Cu–Mn has been studied by thermal analysis, electrical conductivity and hardness measurements, and by microscopic and *X*-ray methods, and the phase diagram of the system is derived. At high temp. two series of mixed crystals are formed. Melts containing 0—75·5% of Mn yield Cu–γ-Mn mixed crystals which show a min. m.p. at 871° (36·5% of Mn). From melts containing 75·5—100% of Mn the initial solid product comprises Cu–δ-Mn mixed crystals, of which the saturation concn. at 1113° is 86·5% of Mn. These mixed crystals decompose at 1113° into a melt containing 75·5% of Mn and γ-mixed crystals containing 88·0% of Mn. The temp. of the $\delta \rightarrow \gamma$ change (1162°) and of the $\gamma \rightarrow \beta$ change (1075°) of Mn are lowered by Cu, but, as α- and β-Mn do not dissolve Cu, the temp. of the $\beta \rightarrow \alpha$ change is unaffected. The saturation concn. of γ-mixed crystals falls to 61·5% of Mn at 750° and 22·5% at room temp.

J. W. S.

Magnetic properties of ferromagnetic impurities in non-ferrous alloys. H. SCHRÖDER (Ann. Physik, 1939, [v], **36**, 71—96).—A rotation of the sample, accompanied by a slow increase in χ, during susceptibility measurements on Zn–Al alloys by the Gouy method, and an apparent influence of magnetic field on the speed of attainment of equilibrium in quenched Zn–Al alloys, are found to be due to the effect of magnetic field on Fe impurities. The magnetic properties of such impurities have been studied. O. D. S.

Structure of the γ-mixed crystals in the system palladium–manganese. Correction. G. GRUBE and O. WINKLER (Z. Elektrochem., 1939, **45**, 784—787).—Measurement of the lattice consts. of quenched Mn–Pd alloys and extrapolation to 100% Mn indicate that the tetragonal face-centred γ-form of Mn, described by various authors as stable at >1191°, is identical with the γ-form found by the authors to be stable at 1070—1160°. The previous description of this form as cubic face-centred (A., 1936, 1455) was due to different heat-treatment. J. W. S.

Effect of intense sound on metallic melts. II. Importance of frequency and intensity of the sound in grain-refining. G. SCHMID and A. ROLL (Z. Elektrochem., 1939, **45**, 769—775; cf. A., 1938, I, 21).—Wood's alloy has been submitted during crystallisation to the action of intense sound and ultrasonic waves of frequency 50, 9000, and 284,000 cycles per sec. and of intensity 1—40 w. per sq. cm. The needle crystals are the shorter the more intense is the sound, but the frequency has no systematic effect. The grain-refining effect is attributed to the frictional energy between the molten metal and the crystals, and rough calculation shows that this is of the same order of magnitude as the tensile strength of the crystals. J. W. S.

Recrystallisation texture of face-centred iron–nickel–copper alloys. H. G. MÜLLER (Z. Metallk., 1939, **31**, 322—325).—After a 99% reduction by cold-rolling the temp. at which recrystallisation of Fe–Cu–Ni commences (1 hr. anneal) follows closely that at which complete homogenisation takes place but is generally a little lower. Whereas both Ni and Cu begin to recrystallise at 220°, the 10 : 10 : 80 Cu–Fe–Ni alloy begins at 550° and the 40 : 30 : 30 at ~990°. Complete cubic reorientation is obtained by annealing at >1000° all alloys on the Ni side of a smooth curve passing through the points, 10 : 65 : 25, 27 : 27 : 46, and 60 : 10 : 30 Cu–Fe–Ni. Adjacent to this line on the Cu–Fe side is a small range in which the alloys develop an irregular texture on annealing and this is followed by a broader range in which the recrystallisation texture is the same as the rolling texture. There is also a small range of alloys about the composition 20 : 40 : 40 Cu–Fe–Ni which show an abnormal recrystallisation in a temp. range ~300° below their normal recrystallisation temp.; an explanation of this phenomenon is offered. A. R. P.

Formation of binary superstructure phases [in copper–gold and iron–nickel alloys] under the influence of additions [of other metals] with limited solubility. H. BUMM (Z. Metallk., 1939, **31**, 318—321).—Addition of 5% of Ag to CuAu and Cu_3Au prevents ordering completely; both compounds dissolve >15% Ag above 700° and since these alloys separate into two phases on slow cooling they can be hardened by quenching and re-heating at 400°. Addition of 10% of Cu has relatively little effect on the ordering of Fe_3Ni, but very small additions of Cr, Mo, and W reduce or inhibit ordering.

A. R. P.

Solubility of carbon dioxide in benzene at elevated pressure. S. W. WAN and B. F. DODGE (Ind. Eng. Chem., 1940, **32**, 95—98).—Pressure–composition isotherms for the system CO_2–C_6H_6 at 150 lb. per sq. in. and at 30°, 40°, 50°, and 60° are recorded graphically. The data for systems containing $\not>$40 mol.-% of CO_2 agree fairly well with vals. calc. from Henry's law. C. R. H.

Hydrotropic action of isomerides of C_7 and C_8 series. C. NEUBERG and H. A. FISCHER (Rec. trav. chim., 1940, **59**, 77—86).—Hydrotropic properties of Na *n*-heptoate, benzoate, methyl*cyclo*pentane- and *cyclo*hexane-carboxylate are compared. The dissolving power of the heptoate is > that of the cyclic compounds. The hydrotropic effects of Na *n*-octoate, phenylacetate, and *o*-, *m*-, and *p*-toluate, and of the isomeric *p*-$C_6H_4Me{\cdot}SO_3Na$ and $CH_2Ph{\cdot}SO_3Na$, are examined. It is possible that unstable derivatives of ortho-acids, *e.g.*, $R{\cdot}C(OH)_3$, $R{\cdot}SO(OH)_3$, are formed.

A. T. P.

Solubilities of salts in dioxan–water solvents. T. W. DAVIS, J. E. RICCI, and C. G. SAUTER (J. Amer. Chem. Soc., 1939, **61**, 3274—3284).—The solubilities of AgOAc, Ag_2SO_4, and $Ba(IO_3)_2,H_2O$ have been determined at 25° in dioxan–H_2O solutions of dielectric

const. 2·10—78·55. The Debye-Hückel a parameters have been calc. from the effect of various salts [KNO_3, $NaNO_3$, $Ba(NO_3)_2$, $MgCl_2$, $KBrO_3$, $KClO_3$] on the solubilities of $Ba(IO_3)_2$ in H_2O and of AgOAc in 10 and 20% dioxan solutions. The observed solubilities are > those predicted by the corr. Born equation, the deviation increasing with % of dioxan. Corrections for the equation are discussed. W. R. A.

Solubility of barium iodate monohydrate in solutions of uni-univalent electrolytes at 25°, and calculation of the dissociation constant of iodic acid from solubility data. S. Naidich and J. E. Ricci (J. Amer. Chem. Soc., 1939, **61**, 3268—3273).—Data are recorded for the solubility at 25° of $Ba(IO_3)_2,H_2O$ in aq. KCl, HCl, KNO_3, and HNO_3, and are considered in relation to the Debye–Hückel equation. Assuming that the mean activity coeff. of $Ba(IO_3)_2$ is the same in aq. HX and aq. KX (X = Cl, NO_3) of the same total ionic strength, the ionisation const. of HIO_3 has been deduced. The thermodynamic const. K_a for HIO_3 is 0·163, in agreement with the best val. 0·1686 derived from conductivity data. W. R. A.

Sulphonates. VI. Effect of sodium chloride on the solubility of sodium dodecanesulphonate and sodium tetradecanesulphonate. Solubility at 50° of calcium dodecanesulphonate and calcium dodecyl sulphate in aqueous solutions of the corresponding sodium salts. H. V. Tartar and R. D. Cadle (J. Physical Chem., 1939, **43**, 1173—1179).—NaCl decreases the solubility of Na dodecane- and tetradecane-sulphonate. There is a sharp break in the solubility–temp. curve due to micelle formation, solubility increasing more rapidly above a crit. temp. NaCl raises the temp. and lowers the concn. at which these micelles begin to form. The solubility of Ca dodecanesulphonate in solutions of the corresponding Na salt at first decreases with increase in concn. of the Na salt on account of common ion action, but passes through a min. and thereafter increases. The solubility of Ca dodecyl sulphate in solutions of the corresponding Na salt increases continuously with increase in Na salt concn., there being no min. solubility. C. R. H.

Solubilities of sodium and potassium salts of nitrophenols and related acids. O. C. Dermer and V. H. Dermer (J. Amer. Chem. Soc., 1939, **61**, 3302—3303).—The aq. solubilities at 30° of the Na and K salts of 2-chloro-3-nitro-p-xylenesulphonic, methyl- and chloro-picric, styphnic, flavianic, picric, nitranilic, picrolonic, and dilituric acids and of Na and K dipicrylamides have been determined. The most sensitive K precipitants are dilituric acid and dipicrylamine. Further substitution would probably decrease their val. W. R. A.

Solubility of sulphonanilides in water and hydrochloric acid.—See A., 1940, II, 40.

Hydrogen bonds involving the C–H linking. VIII. Solubilities of completely halogenated methanes in organic solvents. IX. Nitriles and dinitriles as solvents for hydrogen-containing halogenated methanes. M. J. Copley, G. F. Zellhoefer, and C. S. Marvel (J. Amer. Chem. Soc., 1939, **61**, 3550—3552; 1940, **62**, 227—228; cf. A., 1940, II, 14).—VIII. The solubility of CCl_2F_2 and CCl_3F in 33 solvents of various types is, with 3 exceptions, < that calc., thus showing absence of compound formation, which appears to need at least one residual H in a halogenated methane.

IX. The solubility of CH_2Cl_2 and $CHClF_2$ in $CN\cdot[CH_2]_n\cdot CN$ is < that calc. when $n = 2$ or 3, agrees with that calc. when $n = 4$, and is > that calc. when $n = 8$. This is due to co-ordination of H with CN, which, however, is inoperative when co-ordination is sterically favoured within the dinitrile mol. Such internal co-ordination of CH_2 and CN is evidenced by the b.p. of the dinitriles. R. S. C.

Solubility of iron in aluminium.—See B., 1940, 141.

Extraction of ferric iron from hydrochloric acid solutions by dichloroethyl ether and the formula of the iron compound in the ether. J. Axelrod and E. H. Swift (J. Amer. Chem. Soc., 1940, **62**, 33—36).—The distribution of $FeCl_3$ between $(CH_2Cl\cdot CH_2)_2O$ (I) and aq. HCl has been studied at various concns. Fe^{III} can be extracted quantitatively from solutions 7N. in HCl. Analyses of the ether solution show that the Fe^{III} mol. in (I) is empirically $HFeCl_4,4—5H_2O$, but polymerides and additive compounds with (I) may also be present. W. R. A.

Partition of acetamido-acids between immiscible solvents.—See A., 1940, II, 37.

Ageing and formation of precipitates. XXX. Determination of the specific surface of silver bromide by the radioactive and dye methods. XXXI. Ageing of silver bromide. I. M. Kolthoff and A. S. O'Brien (J. Amer. Chem. Soc., 1939, **61**, 3409—3414, 3414—3419; cf. A., 1939, I, 607).—XXX. When well-aged solid AgBr (I) is shaken with a Ra-Br′ solution, Br′ exchange increases continuously and rapidly with the time of shaking, and much of the Ra-Br′ is incorporated into the solid owing to recrystallisation. The speed of recrystallisation decreases with decreasing temp. Adsorbed gelatin inhibits the recrystallisation of (I) but does not entirely prevent that of fresh AgBr. Wool-violet and methylene-blue adsorbed on (I) limit the exchange between (I) and Ra-Br′ to the surface layer only, and this observation has been used in the determination of the sp. surface of (I) and fresh solid AgBr by the radioactive method.

XXXI. AgBr ages more rapidly in a medium containing excess of Br′ than in one with excess of Ag˙ ions. Further, the speed of ageing depends on [Br′] but not on [Ag˙]. The effect of excess of Br′ is attributed to the adsorption of this ion, giving argentobromide ions in the liquid film around the particles, which results in increased solubility and speed of recrystallisation of AgBr in the liquid jackets. The rate of ageing of the AgBr in presence of excess of Ag˙ ions is unaffected by the presence of KNO_3, by shaking, etc., whilst these have a marked effect on ageing in excess of Br′ ions owing to the formation of a colloidal solution. Ostwald ripening accounts for the observation that, over longer periods of ageing, suspensions which had been previously

shaken aged more quickly than those which had been left undisturbed. Adsorbed gelatin does not prevent the penetration of Ra-Br′ into fresh AgBr when the latter is shaken with a solution of the former (cf. XXX). Increase of the solubility of the ppt. by addition of aq. NH_3 increases the rate of ageing. When the solubility of AgBr has reached a min. the rate of ageing no longer depends on the solubility of the ppt. in the ageing medium. The rate of ageing is approx. const. in aq. and alcoholic 0·001M-$AgNO_3$, in C_6H_6, and in the air-dried state. Fresh AgBr undergoes a rapid thermal ageing in the dry state at room temp. W. R. A.

Addition of carbon monoxide to compounds of univalent copper. H. MÖLLER and K. LESCHEWSKI (Z. anorg. Chem., 1939, **243**, 185—208; cf. A., 1939, I, 273).—The absorptive powers for CO of various Cu^I solutions have been compared. Among solutions of the halides (in presence of excess of alkali halide or H halide), those of CuCl are by far the best absorbents, followed by those of CuBr. CuF and CuI solutions absorb much less CO, and CuCN and CuCNS solutions none at all. Ammoniacal solutions of CuF, CuCl, CuBr, and CuI, but not of CuCN, absorb CO very readily. There is a parallelism between the absorptive powers for CO and for O_2. F. J. G.

Surface migration of ions and contact exchange. H. JENNY and R. OVERSTREET (J. Physical Chem., 1939, **43**, 1185—1196).—A discussion. A theory of ionic movement in colloidal systems involving ions held in the adsorbed state on micelle surfaces is used to explain Fe" migration in gels and sols of bentonitic clays. Plant roots are shown to exhibit the phenomena of surface migration and contact exchange. The latter can be conveniently divided into contact intake, *i.e.*, exchange of H˙ on root surface for nutrient cations on the clay, and contact depletion, *i.e.*, transference of any nutrient ion from the root surface to the clay. C. R. H.

Adsorption of gases on copper at liquid oxygen and liquid hydrogen temperatures and at low pressures. J. BORGHS and A. VAN ITTERBEEK (Physica, 1940, **7**, 17—28).—The adsorption of N_2 on Cu at 67·5—90·1° K. and of Ne at 17·3—20·3° K. is reversible and of the van der Waals type; it is in agreement with Polanyi's theory. Adsorption of H_2 is not reversible, and is the same for the equilibrium ortho–para mixture as for normal H_2. For incomplete saturation, vals. of 7, 11, and 14 were found for the degree of occupation in the case of N_2, Ne, and H_2, respectively. L. J. J.

Adsorption of hydrogen by copper dispersed in calcium oxide. J. R. LEWIS, L. J. E. HOFER, and H. WHITEHEAD (J. Amer. Chem. Soc., 1939, **61**, 3580—3583).—The adsorption of H_2 on pure CaO and on Cu dispersed in CaO has been measured at 650 mm. and at various temp. Adsorption by pure Cu is < by Cu in CaO, and resembles that of H_2 on MgO and on Cu dispersed in MgO (A., 1938, I, 88). For each system activated adsorption occurs. An equation which explains data for Cu dispersed in oxides is given. W. R. A.

Influence of physical and chemical factors on activity of charcoal.—See B., 1940, 103.

Adsorption potentials. I. General theory. R. B. DEAN, O. GATTY, and E. K. RIDEAL. **II. Oil–water potentials.** R. B. DEAN. **III. Air–water potentials.** R. B. DEAN and O. GATTY (Trans. Faraday Soc., 1940, **36**, 161—166, 166—173, 173—179).—I. It is deduced theoretically that films of insol. substances permeable to at least one ionic species cannot affect the p.d. between two phases in equilibrium and can affect diffusion potentials between two phases only when they offer sufficient change in the resistance to passage of at least one ionic species. An expression relating the diffusion potential through a thin and permeable membrane to its resistance to the passage of different ions is derived.

II. A method of investigating the electrical properties of oil–H_2O interfaces is described. Thin oil layers between drops of H_2O carrying films produced by the formation of complexes between cholesterol in the oil and digitonin in the H_2O are stable for several min., but if a polarising potential is applied the drops coalesce more rapidly. Drops protected by an elastic film of ovalbumin are more stable. The diffusion potentials of oil–H_2O systems are considerable and have been studied as a function of the distance of separation of two H_2O drops in oil. The spreading of monolayers at oil–H_2O interfaces leads to a rapid change in the potential across the interface, which decreases with a time const. related to the conductivity of the oil phase. In accord with the theory, monolayers produce no permanent changes either of equilibrium or of diffusion potentials.

III. Air–stearic acid monolayer–aq. solution interfaces attract ionised air particles and any of these hitting the surface condense and are discharged before returning to the air phase. Hence no double layer can build up in the air phase to compensate the field set up by an oriented layer of dipoles. Partial compensation occurs in the aq. phase when the potential is measured through air ionised by a radioactive source; this also occurs when the interface is completely polarisable because the air contains hardly any ions. J. W. S.

Production of colour during adsorption on superficially active materials. Analogy between adsorptive action and complex formation. E. WEITZ and F. SCHMIDT (Ber., 1939, **72**, [*B*], 1740—1742).—Passage of a CPh_3 halide in dry C_6H_6 or $CHCl_3$ through dry SiO_2 gel or, less advantageously, Al_2O_3 gives a coloured zone in which the dissolved substance is completely retained and from which it is withdrawn with destruction of the colour by EtOH or $COMe_2$. Tetra-aryl-*p*-xylylene dihalides behave similarly. With these compounds the union with the adsorbent has the same colour-producing effect as union with an inorg. halide. It must be assumed that the triarylmethyl group is united to the adsorbent causing the transition from a homopolar to a heteropolar union. Tri-*p*-tolylamine does not give a colour with Bz_2O_2 or SiO_2 gel separately but together the three substances become intensely greenish-blue. Doubtless the colour is due to a tritolylaminium salt and shows that heteropolarity is facilitated by union

with an adsorbent. Under similar conditions, an intense green colour is given by $NHPh_2$, carbazole, and 1-methylcarbazole. Tetraphenyl-, tetra-*p*-tolyl-, and tetra-*p*-anisyl-hydrazine give the same colours with well-dried SiO_2 as with $AlCl_3$. H. W.

Sorption of water vapour by vermiculite and its silica. L. A. HANSEN, W. S. SAMUEL, jun., and P. A. FORNI (Ind. Eng. Chem., 1940, **32**, 116—118).—The efficiency and capacity for H_2O adsorption of exfoliated vermiculite (I) activated at 115° for 48 hr. is low. SiO_2 obtained from exfoliated (I) has a high efficiency especially if activated at 250°. There is a slight loss in capacity after reactivation. SiO_2 from unexfoliated (I) is slightly inferior to that from exfoliated (I). The capacity to adsorb EtOH and C_6H_6 is < for H_2O, C_6H_6 being only slightly adsorbed. C. R. H.

Ionic concentrations at interfaces. G. S. HARTLEY and J. W. ROE (Trans. Faraday Soc., 1940, **36**, 101—109).—The local concn. method is applied to the derivation of relationships expressing the ordinary dissociation const. of weak acids, the second dissociation const. of dibasic acids, the effective dissociation const. of acidic groups on large and highly charged colloidal particles, and the p_H near the surface of the particle and in the bulk of the solution. The theory is confirmed by measurements with triethanolammonium cetanesulphonate. J. W. S.

Study of the double layer at the metal–solution interface by electrokinetic and electrochemical methods. A. FRUMKIN (Trans. Faraday Soc., 1940, **36**, 117—127).—Results obtained by various methods are compared and discussed. J. W. S.

Electrochemistry of simple interphases, with special reference to that between mercury and solutions of electrolytes. S. R. CRAXFORD (Trans. Faraday Soc., 1940, **36**, 85—101).—Theories of the structure of the interphase are discussed, with particular application to the interpretation of charge–potential curves for Hg surfaces in contact with various electrolytes. J. W. S.

Tough soap films and bubbles. F. B. WADE (J. Chem. Educ., 1939, **11**, 517—518; cf. A., 1938, I, 355).—A solution of Dreft made with hard or soft H_2O can be used with H_2 directly from a generator to blow bubbles that can be cut off and allowed to rise. L. S. T.

Wettability of solid surfaces. H. DEVAUX (Compt. rend., 1940, **210**, 27—29).—The border of a film produced by a drop of H_2O on a freshly-blown glass surface is progressively resolved into numerous droplets, which coalesce and flow down the surface. A film formed by condensation behaves in a similar way, and no visible residue remains on the glass. Similar phenomena are observed with films of oil on H_2O, Hg, or glass. It is inferred that the only stable phase of the liquid film is a unimol. layer, and any excess of liquid eventually forms globules. Gradual retraction of the liquid film after immersion indicates high wettability, and a unimol. layer remains on the solid surface; if retraction is rapid and adherent drops are left, the wettability is low and no residual layer is formed. Ordinary solid surfaces probably consist of a mosaic of hydrophilic and hydrophobic areas, and the predominance of either type determines the properties of the surface as a whole. A. J. E. W.

Determination of polarity of surfaces by polymeric adsorption. P. A. THIESSEN and E. BEGER (Kolloid-Z., 1939, **89**, 175—177).—The orientation of films of stearic acid (I) can be determined by placing in a solution of pinacyanol chloride and measuring the colour intensity of the adsorbed dye (cf. Scheibe, A., 1937, I, 165). In built-up films of (I) the absorption measured for even layers is approx. twice that for odd layers. F. L. U.

Deactivation of the surface effects taking place during crystallisation of a supercooled organic liquid in thin layers. I. G. L. MICHNEVITSCH and E. N. OVTSCHINIKOVA (Acta Physicochim. U.R.S.S., 1939, **11**, 603—616; cf. A., 1937, I, 562).—The effects of the previous treatment of the glass on the vertical distribution of crystallisation nuclei in a thin layer of supercooled betol between two horizontal glass surfaces has been studied. The glass is completely deactivated by treatment with HF, but gradually regains its activity in the course of repeated fusions and crystallisations of the betol. Treatment of the deactivated glass with lactic acid (I) in EtOH gives it a marked activity if the (I) is sufficiently conc., which decreases with decreasing concn. of (I), but on similar treatment of glass which has not been deactivated, the resulting activity decreases at first with decreasing (I) concn., but subsequently increases. These effects are attributed to the formation of a monolayer of (I) on the glass, with its active ends towards the glass and the inert ends towards the betol. When there is > sufficient (I) the excess mols. facilitate nucleation; when there is just enough to form a complete monolayer the surface is neutral, and when the surface is only partly covered its natural activity shows itself. F. J. G.

Capillary systems. XIX$_9$. Specific permeability and pore structure of packed spheres and heaps of spheres or grains. E. MANEGOLD and K. SOLF (Kolloid-Z., 1939, **89**, 36—47).—Formulæ for the permeability of assemblages of spheres and grains are deduced and compared with published experimental data. F. L. U.

Membrane permeability of dyes. I. Velocity of dialysis of Orange II. T. NISHI (J. Soc. Chem. Ind. Japan, 1939, **42**, 341—342B).—The dialysis const. (*k*) increases to a max. and then falls with increase in dye concn. *k* is also increased by rise in temp. and in presence of H_2SO_4. Addition of NaCl with or without H_2SO_4 increases *k* until a const. val. is attained at ~0·2N-NaCl. C. R. H.

Electrical double layer. E. K. RIDEAL (Trans. Faraday Soc., 1940, **36**, 1—4).—Theories of the origin and structure of the electrical double layer in colloidal systems are summarised and discussed. J. W. S.

Theoretical treatment of the double layer and its implications. H. R. KRUYT and J. T. G. OVERBEEK (Trans. Faraday Soc., 1940, **36**, 110—116).—Methods of determination of the electrokinetic potential, the p.d. in the Gouy double layer, and the

charge on the double layer in colloidal systems are discussed. J. W. S.

The Helmholtz. E. A. GUGGENHEIM (Trans. Faraday Soc., 1940, **36**, 139—144).—The distinction between the moment τ of an electrical double layer and the p.d. ϕ across a double layer is emphasised. The "Helmholtz" (1 D./A.^{2}) is suggested as a unit of the moment of an electrical double layer. The conversion from the electrokinetic potential (ζ) in v. to τ in Helmholtz is then given by ζ v. $= \epsilon\zeta/12\pi$ Helmholtz. J. W. S.

Influence of particle size on the physical behaviour of colloidal systems. H. C. HAMAKER (Trans. Faraday Soc., 1940, **36**, 186—192).—The effects of the size of particles in a suspension or colloidal solution on the various forces acting on them are summarised and discussed with reference to the behaviour of such systems under gravity or in a centrifuge. It is suggested that observations on the properties of a deposit obtained by centrifuging may provide valuable information concerning the shape of the potential curves valid in the sol. J. W. S.

Significance of the phenomenon of the electrical charge on the stability of hydrophobic dispersions. H. EILERS and J. KORFF (Trans. Faraday Soc., 1940, **36**, 229—241).—The data on which the relation between the ζ-potential and stability of lyophobic colloids is based are criticised, and it is shown that the assumption of a crit. potential has no adequate basis but that the controlling factor is the energy required to bring together two particles of the dispersion against the action of their electric field. This energy is shown to be $C\zeta^2/\kappa$, where $\kappa = 10^{7\cdot364}\sqrt{\{\Sigma(cz^2)\}}$. The formula is applied to data on the stability of oil-in-H_2O emulsions and of suspensoids, and is shown to account better for the observed facts than does the assumption of a crit. potential. J. W. S.

Repulsive forces between charged colloid particles and theory of slow coagulation and stability of lyophobe sols. B. DERJAGUIN (Trans. Faraday Soc., 1940, **36**, 203—215).—A formula relating the interaction of plane surfaces with the interaction of spherical surfaces separated by the same liquid is derived. On the basis of the theory of strong electrolytes the force and energy of interaction between spherical conductors (micelles) immersed in an electrolyte, and a general expression for the free energy of charged conductors in electrolytes, are derived. The velocity of slow coagulation and stability of lyophobic sols are calc. as functions of their ζ-potential, and it is shown that the crit. ζ-potential for stability is $\sim$30 mv. Measurements of the forces of repulsion exerted by thin multimol. liquid films on glass and other hydrophilic surfaces show great deviations from the theoretical vals. at medium and high. concns., suggesting a non-electrostatic mechanism of this effect. For most of the liquids investigated the pressure of thin films decreases to zero only when its thickness is $\sim$0·2—0·3 μ., indicating the large radius of action of surfaces on neighbouring liquid layers. Neither van der Waals nor dipole forces are responsible for these effects. The pressure of thin layers of liquids depends on the concn. of dissolved mols., including non-electrolytes, and this may be connected with the diffuseness of adsorption layers in non-electrolytic solutions as well. The effect can be used to explain the mechanism of the stabilising action of surface-active substances. J. W. S.

Stability properties in hydrophobic sols; application of the mutual energy of two particles. S. LEVINE and G. P. DUBE (Trans. Faraday Soc., 1940, **36**, 215—229).—The theory of interaction between colloidal particles (A., 1939, I, 520) is applied to the discussion of the energy at contact, the energy max., and slow coagulation. J. W. S.

Electrical double layer in relation to the stabilisation of emulsions with electrolytes. D. F. CHEESMAN and A. KING (Trans. Faraday Soc., 1940, **36**, 241—247; cf. A., 1938, I, 455).—Investigations on the system $C_5H_{11}\cdot OH$–H_2O indicate that certain electrolytes stabilise emulsions of H_2O in polar org. liquids or of polar org. liquids in H_2O. The stabilising effect is evident over a limited concn. range and a well-defined optimum concn. exists for each electrolyte. The stabilising effects of K salts follow the order CNS′ > I′ > NO_3' > Br′ > ClO_3' > Cl′ > SO_4'', whilst the effects of chlorides follow the order $Sr^{\cdot\cdot}$ > $Ca^{\cdot\cdot}$ > $K^{\cdot}$ > $Li^{\cdot}$. In H_2O-in-oil emulsions the H_2O globules are positively charged. It is suggested that since salts with anions at the hydrophobic end of the lyotropic series are appreciably sol. in $C_5H_{11}\cdot OH$ there will be a tendency for the anions to collect on the $C_5H_{11}\cdot OH$ side of the interface, while the cations collect in the aq. phase. Hence the globule bears at its surface the positive side of a double layer which tends to stabilise the emulsion. This view, combined with Gouy's conception of the diffuse ionic layer, accounts for the max. stability being attained at a concn. which varies for different electrolytes. Stable emulsions of H_2O in *cyclo*hexanone and COPhMe can be obtained without addition of electrolyte. This is attributed to the provision of stabilising ions by the org. compounds themselves. J. W. S.

Effect of ultrasonic waves on colloid phenomena. V. Influence on thixotropy. II. Thixotropic systems of ferric hydroxide. N. SATA and N. NARUSE (Kolloid-Z., 1939, **89**, 341—344; cf. A., 1939, I, 142).—Gelatinisation times of thixotropic Fe_2O_3 sols containing NaCl are increased by ultrasonic waves when [NaCl] is small but decreased when it is large. The former effect is attributed to the destruction of the hydration layer, and the latter to orientation of the particles by the waves. F. L. U.

Dependence of [result of] freezing ferric oxide hydrosols on their composition and on the method of freezing. A. LOTTERMOSER and G. SCHMOLE (Kolloid-Z., 1939, **89**, 328—340).—Fe_2O_3 sols containing sufficient electrolyte can be frozen and thawed without coagulation occurring, but with progressive removal of electrolyte by dialysis they coagulate irreversibly on freezing. Ageing of a partly dialysed sol, or addition of HCl, restores the reversibility. Measurements of the Cl attached to the colloidal complex (Cl_c) and of that present in the

counter-ion atm. (Cl_a) and in the ultrafiltrate (Cl_u) show that a condition of reversibility is a sufficiently high ratio of ($Cl_a + Cl_u$) to Cl_c rather than the total Cl content. An explanation of the behaviour has not been found. F. L. U.

Action of immiscible organic liquids on aqueous dispersions. T. R. Bolam and G. Bowden (Rec. trav. chim., 1939, **58**, 1109—1118).—The distribution of colloidal Au and of colloidal AgI between H_2O and immiscible org. liquids in presence of varying concns. of different electrolytes is shown in tables. The org. liquids used were $C_5H_{11}\cdot OH$, Et_2O, and ligroin. In general the effect of stabilising ions in sufficient concn. is to keep the colloid in the aq. phase. Non-stabilising electrolytes cause accumulation at the interface, or (with $C_5H_{11}\cdot OH$ and Et_2O only) promote the passage of the colloid into the org. liquid. With increasing [$AgNO_3$] AgI passes from the org. liquid ($AgNO_3$ 0·1—10 mmol. per l.) to the interface (20—45) and then into the aq. phase (45—75). The observed effects were produced in every case at electrolyte concns. $\ll$ those needed for coagulation. It is suggested that adsorption of the org. liquid is prevented by the electric field at the surface of the colloid under stabilising conditions. F. L. U.

Influence of "T" and "R" activation on colloidal arsenic trisulphide. G. Piccardi (Gazzetta, 1939, **69**, 722—730; cf. A., 1938, I, 604).—Differences in colour intensity and in velocity of filtration and of flocculation of As_2S_3 sols prepared with normal and with "T" and "R" activated H_2O are described. O. J. W.

Electrochemical properties of colloidal silicic acid. I. Interaction with bases. II. Interaction with neutral salts. B. Chatterjee (J. Indian Chem. Soc., 1939, **16**, 589—606, 607—615).—The interaction of SiO_2 sols with different bases [NaOH, $Ba(OH)_2$, $Ca(OH)_2$] has been studied potentiometrically. The sols behave as strong acids, as shown from a comparison of the free and total acidities (at the first inflexion points) of the sols and of their ultrafiltrates. First inflexion points in the titration curves indicate the full neutralisation of an acid between p_H 4·5 and 5·6. From a comparison of the slopes of the various titration curves, $Ca(OH)_2$ reacts $>$ $Ba(OH)_2$ $>$ NaOH, but the [H_2SiO_3] neutralised by these bases is the same at the respective inflexion points. A second inflexion point has been observed between p_H 11·0 and 11·7 using conc. aq. NaOH, and the lower is the [SiO_2] of the sol, the lower is the p_H of this point. The total acidity calc. from the second inflexion point $\simeq$ the [SiO_2] of the sol expressed in g.-mol. per l. The formation of $NaHSiO_3$ at the second inflexion point is indicated. The ultrafiltrates of different sols contain different amounts of dissolved H_2SiO_3. The buffer capacity curves show only one max. about the half-neutralisation point, the val. of which is $\gg$ that of an acid in true solution.

II. The power of different cations to liberate acid from colloidal SiO_2 is $Ba^{\cdot\cdot} > Ca^{\cdot\cdot} > Na^{\cdot} > Li^{\cdot}$, in agreement with the theory of interchange between $H^{\cdot}$ ions in the double layers of the colloidal particles of the sol and the cations of the added salts (A., 1927, 107). The total acid concn. liberated by $BaCl_2$, $Ca(OAc)_2$, $Ba(OAc)_2$, and $CaCl_2$ is $\gg$ that neutralised at the first inflexion point in the titration curve of a SiO_2 sol with a dil. base. At low concns., alkali metal cations effect only an osmotic displacement of the mobile $H^{\cdot}$ ions. W. R. A.

Electrochemical properties of stearic acid hydrosol. I. S. Mukherjee and N. P. Datta. **II.** N. P. Datta (J. Indian Chem. Soc., 1939, **16**, 563—572, 573—582).—The electrometric titration of stearic acid hydrosols with $Ba(OH)_2$ and $Ca(OH)_2$ shows that the system is two-phase and the salt formed by the interaction forms a separate phase. The NaOH titration curves differ from those of a weak acid with a strong base in that the max. buffer index corresponds not with half-neutralisation but with greater [NaOH]. p_H is const. between 6·5 and 7·0 in $Ba(OH)_2$ titrations, and between 9 and 9·5 in NaOH titrations. The total acidity, calc. from the inflexion points, $\simeq$ the stoicheiometric acid concn. Added neutral salts ($BaCl_2$, KCl) do not affect the val. of the total acidity. Ultrafiltrates of the sol and salt mixtures give only a fraction of the total acidity of the sol.

II. The aq. solubility of stearic acid is $1·17 \times 10^{-5}$N. at 35° and $5·77 \times 10^{-5}$N. at 50°, and the dissociation const. is $1·7 \times 10^{-6}$ and $2·6 \times 10^{-6}$ at 35° and 50° respectively. The p_H of the sol at 35° is $>$ at 50°, but the total acidity is const. Addition of neutral salts (KCl, $BaCl_2$, $CaCl_2$) causes the $H^{\cdot}$ activity of the sol to increase. The solubilities of Ba and Ca stearates are $9·02 \times 10^{-6}$N. and $6·15 \times 10^{-6}$N. respectively at 35°, and $2·21 \times 10^{-5}$N. and $2·33 \times 10^{-5}$N. respectively at 50°. W. R. A.

Phase-rule behaviour of concentrated aqueous systems of a typical colloidal electrolyte. Sodium oleate. R. D. Vold (J. Physical Chem., 1939, **43**, 1213—1231).—From data obtained by several independent methods, a phase diagram of the system Na oleate–H_2O has been constructed. The succession of phase changes in anhyd. Na oleate as the temp. is raised is similar to that found for Na palmitate. C. R. H.

Types of micelle in aqueous soap solutions. J. Stauff (Kolloid-Z., 1939, **89**, 224—233).—The presence of both large and small micelles in aq. solutions of Na tetradecyl sulphate (I) and of Na laurate (II) is established by *X*-ray measurements. The large micelles, which appear in (I) at a concn. of 0·1N. and in (II) at 0·2—0·25N., contain H_2O between the polar groups, and behave as cryst. liquids (cf. A., 1939, I, 319). They are electrically charged and cannot therefore be identified with McBain's "neutral colloid." F. L. U.

***X*-Ray and viscosity investigations of the effect of foreign substances on the structure of sodium oleate solutions.** H. Kiessig and W. Philippoff (Naturwiss., 1939, **27**, 593—595).—Substances insol. in H_2O (*e.g.*, C_6H_6) dissolve in Na oleate (I) solution, and the η of the solution is greatly altered. This is also the case when electrolytes are added. *X*-Ray diagrams given by a 15% (I)

solution, and one to which 0·39 g. of C_6H_6 per 1 g. of solid Na oleate has been added, show that the distance between the lattice planes in the direction of the hydrocarbon chain is increased from 84 to 100 A. on addition of C_6H_6, so that the C_6H_6 taken up by the Na oleate is included in the cryst. ordered micelles. No C_6H_6 is taken up between the (I) mols. With increasing concn. of C_6H_6 the increase in the distance between the lattice planes increases considerably. The η of the solutions was also determined. The curve of η against concn. of C_6H_6 shows a max. which may be due to aggregation. Although addition of 1% NaOH to (I) solutions increases η 1000 times, there is no alteration in the *X*-ray diagram. This is explained by assuming an aggregation of the original cryst. micelles to disordered secondary micelles. A. J. M.

Interfacial phenomena in silica gels. Sorption, catalysis, and dyeing. R. Köppen (Kolloid-Z., 1939, **89**, 219—223).—From the change in p_H of the external solution observed when NaOH is added to electro-dialysed SiO_2 gel it is inferred that the gel particles are surrounded by a double layer of which OH ions are an important constituent. The adsorption of methylene-blue and the catalysis of EtOAc hydrolysis are attributable to the presence of OH′ in the double layer rather than to a sp. action of the gel surface; both these actions are greatly diminished when other anions (Cl′ etc.) are substituted for OH′. F. L. U.

ζ-Potential at the interface solid/water in relation to micellar structure. I, II. Change in ζ-potential of hydrate cellulose after direct conversion into ordinary cellulose. K. Kanamaru and T. Takada (J. Soc. Chem. Ind. Japan, 1939, **42**, 275—283B).—The conversion of hydrate celluloses (viscose) into ordinary cellulose by heating for 1 hr. at 250° in glycol causes increased ζ against H_2O, decreased rate of fall and total fall of ζ on prolonged immersion, and decreased absorption of H_2O at a given R.H. The changes are greatest in viscose spun at the lowest speed, in which the degree of orientation of the crystallites is least. They are ascribed to the increased orientation of the treated cellulose and to the change in the crystal lattice. The effect on the adsorptive forces of changes in lattice structure, orientation, and size of crystallite in solids is discussed. W. A. R.

Osmotic pressure and state of the solvent in the system acetone–cellulose nitrate. C. G. Boissonas and K. H. Meyer (Z. physikal. Chem., 1939, **B, 44**, 392—396).—Polemical. Schulz' osmotic pressure vals. (cf. A., 1938, I, 512; 1939, I, 319) are incorrect. A. J. E. W.

Mechanism of deformation of hydrocellulose. VI (2). Viscosity determinations on stretched and unstretched filaments. J. de Booys, H. L. Bredée, and P. H. Hermans (Rec. trav. chim., 1940, **59**, 73—76).—Determinations of η of cellulose dissolved in Triton B (? $CH_2Ph{\cdot}NEt_3{\cdot}OH$) and in cuprammonium solution show no detectable difference between stretched and unstretched filaments. It is inferred that mol. chains are not broken in the process of deformation and rupture of the filaments (cf. A., 1939, I, 141). F. L. U.

Mechanism of deformation and fine structure of hydrocellulose. XIII, XIV. Load–extension diagrams of isotropic cellulose fibres from point of view of theoretical relation between anisotropy of swelling, orientation, and load. I. Fibres with different degrees of swelling. II. Fibres prepared in different ways. P. H. Hermans (Kolloid-Z., 1939, **89**, 344—348, 349—354).—XIII. The load–extension curves which refer to different degrees of swelling become expressible by a single general equation when the "characteristic degree of extension" v_t is used in place of the conventional quantity v (cf. A., 1939, I, 418). With swollen fibres the tension is approx. ∝ sin² (mean angle of orientation of micelles) up to an extension of 150% ($v_t = 2{\cdot}5$).

XIV. The curves representing the relation between v_t and anisotropy of swelling become flatter (*i.e.*, the orientation increases more slowly) for cellulose xanthate fibres spun from liquids of decreasing cellulose content. The load–extension curves for such fibres are in agreement with the theoretical relation between degree of orientation and load. F. L. U.

Combination of gelatin with acids and bases. L. Friedman, K. Klemm, and F. K. Thompson (J. Physical Chem., 1939, **43**, 1133—1137).—A comparison of the data from η studies of the combination of gelatin (I) with $HClO_4$, H_2SO_4, H_3PO_4, AcOH, KOH, and aq. NH_3 with similar data for HCl and NaOH indicates that such combinations cannot be explained as combinations of (I) with H˙ or OH′. C. R. H.

Mechanism of water adsorption in gelatin gel. A. Weidinger and H. Pelser (Rec. trav. chim., 1940, **59**, 64—72).—The side-chain spacing of gelatin (I) gels, as revealed by *X*-ray spectrograms, is not affected by the presence of small proportions [2% of the dry (I)] of $CoCl_2$, which is therefore confined to the intermicellar liquid. The amount of bound H_2O given by Hatschek's $CoCl_2$ method (A., 1936, 796) is the same as that deduced from the relation between side-chain spacing and H_2O content. "Bound" H_2O is therefore identified with intramicellar H_2O. F. L. U.

Adsorption of alkali by wool.—See B., 1940, 122.

Quantitative measurement of coagulation. H. A. Wannow (Kolloid-Beih., 1939, **50**, 367—474).—A detailed account is given of the method previously described (A., 1939, I, 78) and of its application to the investigation of various problems in coagulation. F. L. U.

Oriented coagulation in aerosols. III. Tensile strength of aerosol sediments. D. Beischer (Kolloid-Z., 1939, **89**, 214—219; cf. A., 1939, I, 334).—Aerosols of Fe_2O_3, made by photo-oxidation of $Fe(CO)_5$ vapour, and of ZnO, from $ZnEt_2$ vapour and air, were coagulated in an electric field (300 v. per cm.) to thread-like aggregates. From the length attained by the filaments before breaking under their own wt. their tensile strength (s) was calc. to be 15—25 and ∼50 g. per sq. cm. respectively. Vals. of s of ∼500 g. per sq. cm. were obtained for single filaments of NH_4Cl, As_2O_3, and anthracene, in which microscopic

examination showed the constituent particles to be cryst. Far higher vals. of *s* are found with p-$NH_2 \cdot C_6H_4 \cdot N_2 \cdot Ph$ (5—10 kg. per sq. cm.) (cf. A., 1936, 679) and with Fe produced by thermal decomp. of $Fe(CO)_5$ (10—40 kg.), in each of which the forces of attraction between the particles are partly coulombic. Calculation by Hamaker's formula (A., 1938, I, 14) for spherical particles acted on only by London–van der Waals forces leads to vals. of *s* of the same order of magnitude as those found for Fe_2O_3 and ZnO. F. L. U.

Making visible the adsorption of colloidal metals on proteins. I. Reaction between colloidal gold and tobacco mosaic virus. G. A. KAUSCHE and H. RUSKA (Kolloid-Z., 1939, **89**, 21—26; cf. A., 1939, III, 729).—The reactions of tobacco mosaic virus (I) with colloidal Au have been observed with an electron microscope (cf. A., 1938, III, 768; 1939, I, 389). In the region of "red flocculation" the Au particles are seen to be separately attached to the filaments of (I) and to be released by the action of dil. NaOH. In the "blue flocculation" which occurs in the weakly acid and neutral range the Au particles are irreversibly coagulated without the participation of (I). Photomicrographs are given. F. L. U.

Theory of electrokinetic phenomena. W. HORWITZ (J. Chem. Educ., 1939, **11**, 519—534).—A review. L. S. T.

Electrokinetics. XXIII. Electrokinetics as a tool for the study of the molecular structure of organic compounds. R. A. GORTNER (Trans. Faraday Soc., 1940, **36**, 63—68).—Results published previously (A., 1938, I, 397; 1939, I, 418) are summarised and reviewed. J. W. S.

Electrokinetic equations and surface conductance. Survey of the diffuse double layer theory of colloidal solutions. J. J. BIKERMAN (Trans. Faraday Soc., 1940, **36**, 154—160).—Theoretical. Inclusion of surface conductivity terms yields electrokinetic equations which account for experimental observations such as the max. of electrokinetic potential and the high ϵ of some sols. J. W. S.

Relaxation effects in the double layer. Cataphoresis; dielectric constant. J. J. HERMANS (Trans. Faraday Soc., 1940, **36**, 133—139; cf. A., 1938, I, 619).—The theory of double layer distortion for charged spherical particles moving in an external electric field, and the assumptions underlying the theory, are discussed. The implications of the expression for cataphoretic velocity deduced from this theory are outlined. The anomalous dielectric consts. observed for proteins may be due to the effect of double layer distortion. J. W. S.

Microscopic method of electrophoresis and its application to the study of ionogenic and non-ionogenic surfaces. H. A. ABRAMSON (Trans. Faraday Soc., 1940, **36**, 5—15).—Various arrangements developed for the study of the electrophoresis of microscopically visible particles are described and discussed. Results obtained with particles having ionogenic amphoteric surfaces and with those having non-ionogenic surfaces are described and classified. J. W. S.

Observations at the electrophoretic moving boundary with Lamm's scale method. R. A. KEKWICK (Trans. Faraday Soc., 1940, **36**, 47—52).—The use of Lamm's scale method for observation of the electrophoretic moving boundary is discussed. Typical results obtained for ovalbumin (I), a mixture of (I) and lactoglobulin, and normal human serum, and the interpretations which can be drawn from such measurements are discussed. J. W. S.

Examination of electrokinetic charge density as a function of the thickness of the double layer. A. J. HAM and E. D. M. DEAN (Trans. Faraday Soc., 1940, **36**, 52—57).—The electrophoretic mobilities of dispersions of $C_{18}H_{38}$ in 0—0·1M-NaCl, 0—0·1M-$BaCl_2$, and 0—0·02M-$LaCl_3$ of p_H 5 have been measured at 25°. Both the mobilities and electrokinetic potentials (ζ) decrease regularly with increasing salt concn. and approach limiting vals. which are the lower the higher is the valency of the cation. The charge density (σ) calc. from Gouy's theory increases regularly with increasing concn. of NaCl or $BaCl_2$ and irregularly with increasing concn. of $LaCl_3$, the latter effect being due to the fact that in very dil. solutions of $LaCl_3$ the mobility and hence ζ falls rapidly enough to cause a decrease in σ. When the thickness of the double layer is fixed by making the solution 0·01M. in NaCl, both σ and ζ are decreased by addition of $BaCl_2$ or $LaCl_3$. It is suggested that in the cases in which σ appears to increase whilst ζ falls the anomalous behaviour is due to the use of incorrect vals. of the thickness of the double layer in the calculation of σ. Probably some factor not allowed for in Gouy's theory operates in such cases to decrease the diminution in the thickness of the double layer with increase of electrolyte concn. J. W. S.

Application of the Debye–Hückel theory to disperse systems. R. AUDUBERT (Trans. Faraday Soc., 1940, **36**, 144—153).—The mobilities of gamboge and mastic particles have been measured in solutions of various electrolytes. At low electrolyte concn. the results correspond with those predicted by the Debye–Hückel theory, but at higher concns. divergencies are observed which are the greater the higher is the valency of the added ion of opposite sign to the particle. Ions, however, also cause sp. effects. It is suggested that the range of validity of the Debye–Hückel equation might be extended by using further terms of the series of which the simple equation uses only the first term, but nevertheless other surface processes such as selective adsorption and chemical reactions must be taken into account. J. W. S.

Properties of detergent solutions. IX. Electrophoretic mobility of oil drops in detergent solutions. J. POWNEY and L. J. WOOD (Trans. Faraday Soc., 1940, **36**, 57—63; cf. A., 1938, I, 355).—The mean electrophoretic mobility (u) of highly refined mineral oil (Nujol) in H_2O has been shown to be 4·35 μ./sec./v./cm. at 25°. In 0·0035N-NaCl u is reduced to 0·5 of its val. in pure H_2O. NaOH, Na_2SiO_3, Na_2CO_3, $Na_4P_2O_7$, and $NaHCO_3$ cause an increase in u, the effect being the greater the higher is the p_H of the solution. u for Nujol is increased considerably by the addition of small amounts of $C_{12}H_{25} \cdot SO_4Na$, attaining a max. attributed to the

adsorption of single long-chain ions. The subsequent slight decrease in u with increasing [$C_{12}H_{25}\cdot SO_4Na$] is probably due to secondary adsorption of $Na^{\cdot}$ ions. u increases again sharply near the crit. concn. of the salt, where an increasing proportion of the $Na^{\cdot}$ ions may become associated as gegenions with the ionic micelles, thereby decreasing the [$Na^{\cdot}$] in the solution and hence the $Na^{\cdot}$ effect. Only 0·001% of dodecylpyridinium chloride is necessary to reverse the sign of the net charge on Nujol particles, whilst 0·01% gives max. u. Under these conditions the long-chain ions may lie horizontally or with the hydrocarbon chains oriented towards the aq. phase. There is a slight decrease in u at higher concn., probably owing to Cl' ion effect. In aq. Na laurate and Na oleate, the u of Nujol shows the same crit. changes as in aq. $C_{12}H_{25}\cdot SO_4Na$. J. W. S.

Influence of electrolyte concentration on electrophoretic mobility of egg-albumin. A. TISELIUS and H. SVENSSON (Trans. Faraday Soc., 1940, **36**, 16—22).—The mobility of ovalbumin (I) in phosphate buffer solutions of p_H 7·1 and of various ionic strengths (I) has been determined at 0·5° by the moving boundary method. At very low I the protein migrates as a free ion, and the decrease in mobility caused by increasing I is in accord with the Debye–Hückel–Henry theory of electrophoresis. The increase of the p_H of the isoelectric point of (I) in NaOAc–AcOH buffer solutions with decreasing I is attributed, in part at least, to combination of the buffer ions with the protein. J. W. S.

Membrane potentials, valencies, and theoretical and observed mobilities of hæmoglobin and egg-albumin. G. S. ADAIR and M. E. ADAIR (Trans. Faraday Soc., 1940, **36**, 23—32).—The osmotic pressures and membrane potentials of ovalbumin (I) solutions in PO_4''' buffers of various ionic strengths have been measured. The mean electric charge (valency) of the particles and the excess of inorg. ions near the protein ion are deduced. The results are compared with measurements of the cataphoresis of (I) (cf. preceding abstract). The mobility of CO-hæmoglobin at various p_H, as measured by the moving boundary method, is in accord with the val. calc. by Henry's formula from measurements of the charge and ionic radius. J. W. S.

Influence of electrolytes on electrophoretic mobility of serum-albumin and hæmocyanin. P. PUTZEYS and P. VAN DE WALLE (Trans. Faraday Soc., 1940, **36**, 32—38).—The mobilities of hæmocyanin (I) and serum-albumin (II) particles have been measured in OAc' buffer solutions, 0·01M. in Cl', of various p_H vals. in presence of $Na^{\cdot}$, $Li^{\cdot}$, $Mg^{\cdot\cdot}$, $Ca^{\cdot\cdot}$, or $Ba^{\cdot\cdot}$. For solutions containing $Na^{\cdot}$, the isoelectric point of (I) is approx. const. for ionic strengths (I) 0·02—0·06, whilst that of (II) increases by 0·04 unit as I is increased from 0·03 to 0·06. With $I = 0·03$, bivalent cations increase the isoelectric point of both colloids by 0·15—0·22 unit. The mobilities observed are in only partial accord with the approx. theoretical relationships between the mobility and the p_H and I of the solution. J. W. S.

Electroviscous effect in egg-albumin solutions. H. B. BULL (Trans. Faraday Soc., 1940, **36**, 80—84).—The η, ϵ, and electrophoretic mobilities of dil. solutions (<1%) of ovalbumin have been measured at 35°, at various p_H vals., and with and without the addition of NaCl. The electroviscous effect observed is not in accord with either the Smoluchowski or the Krasny-Ergen equations, but an empirical relationship is developed which is in accord with the behaviour observed. J. W. S.

Electrophoretic studies of wool.—See B., 1940, 122.

Rôle of forces between particles in electrodeposition and other phenomena. H. C. HAMAKER and E. J. W. VERWEY (Trans. Faraday Soc., 1940, **36**, 180—185).—The parallelism between electrophoretic deposition and sedimentation under gravity suggests that electrodeposition is mainly a mechanical problem, the rôle of the electric field being principally to provide a force which moves the particles towards, and presses them together on, the electrode. Two different types of potential curves are capable of explaining the phenomena, but the slight differences in the properties of the layer anticipated in each case are insufficient to permit discrimination between the theoretical possibilities. J. W. S.

Streaming potentials and surface conductance. A. J. RUTGERS (Trans. Faraday Soc., 1940, **36**, 69—80).—Results published previously (A., 1939, I, 143) are summarised. A new apparatus for measurement of streaming potential is described and results with aq. KCl (0—0·0004M.), HCl (0—0·0002M.), $CaCl_2$ (0—0001M.), and $Al(NO_3)_3$ (0—0·30 × 10^{-6}M.) are discussed. J. W. S.

The task and importance of rheology. S. ERK (Kolloid-Z., 1939, **89**, 208—211). F. L. U.

Influence of pressure on water-gas and other equilibria.—See B., 1940, 103.

Equilibrium and kinetics of the thermal isomerisation of dichloroethylene catalysed by iodine. R. E. WOOD and R. G. DICKINSON (J. Amer. Chem. Soc., 1939, **61**, 3259—3263).—Dielectric consts. of various liquid mixtures of *cis*- and *trans*-$C_2H_2Cl_2$, and of their solutions in C_6H_6, *cyclo*hexane, and decahydronaphthalene have been measured at 25°. Using I as catalyst, equilibria have been established between the *cis*- and *trans*-modifications and determined in the pure liquids and in the solutions at various temp. (130—160°). The rates of isomerisation in the different media have been measured, starting with each isomeride. The medium has little effect on the rates and activation energies. The kinetics are compatible with an I atom catalysis. W. R. A.

Application of surface tension measurements to determination of molecular compounds of zinc nitrate and certain alkali nitrates. R. CHAUVENET (Compt. rend., 1940, **210**, 50—52; cf. A., 1939, I, 154).—Surface tension (γ) vals. determined by the drop-wt. method are recorded for aq. solutions containing the nitrates in varying relative proportions. Deviations of γ from the additive vals. indicate the existence in solution of mol. compounds mZn$(NO_3)_2$,nMNO$_3$, with the following $m : n$ ratios : M

= Li, 9 : 7, 1 : 1, 3 : 5; Na, 2 : 1, 1 : 1, 1 : 2, 1 : 3; Cs, 5 : 3, 1 : 1, 7 : 9. The *compound* $Zn(NO_3)_2,NaNO_3,5{\cdot}5H_2O$ has been isolated.

A. J. E. W.

Strong and weak dipole-formers. K. L. WOLF and H. HARMS (Z. physikal. Chem., 1939, **B, 44,** 359—373).—A theoretical discussion in which non-electrolytes with large and small tendencies to form free mol. dipoles in non-polar solvents are compared with strong and weak electrolytes. The dipole-formers may be classified as strong ($COMe_2$) or weak (EtOH, AcOH), according to the nature of the variation of orientation polarisation (corresponding with electrolytic conductivity) with concn. (*c*). Association of weak dipole-formers, shown by the variation of apparent mol. wt. with *c*, is analogous to dissociation of weak electrolytes and is governed by mass-action effects, providing a parallel with the Ostwald dilution law. Variations of the heat of mixing and effective mol. vol. are discussed, and the association of weak dipole-formers is discussed with reference to EtOH and EtSH.

A. J. E. W.

Equilibria in hydrofluoric acid solutions. W. A. ROTH (Annalen, 1939, **542,** 35—43).—Vals. of Λ and of [H˙] for aq. HF are given for concns. up to 0·5M. and temp. 15—25°. Assuming H˙, F′, HF_2', and HF to be the only species present, $K_1 = [H^{\cdot}][F']/[HF] = 0{\cdot}00032$ and $K_2 = [F'][HF]/[HF_2'] = 0{\cdot}0335$ at 20°. For the first reaction $\Delta U_{293} = -3{\cdot}05$ kg.-cal., and for the second $-5{\cdot}07$ kg.-cal. The strongly exothermic nature of the dissociation of HF and of HF_2' is attributed to the large hydration of F′.

F. L. U.

Simplified nomenclature for the proton transfer concept of acids. H. N. ALYEA (J. Chem. Educ., 1939, **11,** 535—538).—Tentative recommendations are put forward. These include a terminology according to the Brønsted system, and numerous relevant definitions. A bibliography on the proton transfer system of acids and bases is given.

L. S. T.

***pK$_c$* Values of γ-dinitrophenol at varying concentrations of NaCl.** K. SHINOHARA and A. INABA (J. Pharm. Soc. Japan, 1939, **59,** 124—126).—The vals. are determined by means of a Gillespie type colorimeter, OAc′ buffer containing varying amounts of NaCl being used.

H. W.

Effects of salt mixtures on dissociation of glycine and alanine. A. C. BATCHELDER and C. L. A. SCHMIDT (J. Physical Chem., 1939, **43,** 1121—1132).—Data for the influence of chloride mixtures on the p_H of alkaline solutions of glycine and alanine (I) are reported. The effect of bivalent salts on the ionisation of (I) in alkaline solutions differs from that of univalent salts and also from calc. effects. Explanations based on the formation of complexes or of insol. hydroxides are suggested.

C. R. H.

Electrolytic dissociation of dicarboxylic acids in water and in aqueous alkali chloride solutions. B. ADELL (Z. physikal. Chem., 1939, **185,** 161—206).—The concn. dissociation consts. (K_c' and K_c'') for a no. of dicarboxylic acids in NaCl and KCl solutions at 18° have been determined electrometrically over a wide range of ionic strength. The acids studied were $CO_2H{\cdot}[CH_2]_n{\cdot}CO_2H$ ($n = 1$ to 7), $(CO_2H{\cdot}[CH_2]_n)_2S$ ($n = 1$ to 3), and $[CH_2]_n(S{\cdot}CH_2{\cdot}CO_2H)_2$ (I) ($n = 0$ to 5). *Tetramethylenebisthioglycollic acid*, [(I), $n = 4$], m.p. 122°, is new. By extrapolation to zero ionic strength the thermodynamic dissociation consts., K_a' and K_a'' are derived. The dependence of K_a' on *r*, the distance between the CO_2H groups, is given by $pK_a' = \text{const.} + S/r^2$ where *S* is a const. characteristic of the homologous series, when *r* is obtained by Ingold's method (A., 1931, 1126) from the vals. of K_a' and K_a''. In a given series, *r* increases with increasing chain length, and for the *n*-paraffin dicarboxylic acids is consistent with a rigid zig-zag model, but substitution of S for CH_2 leads to a decrease of *r* which is greater the greater is the chain length, and the vals. cannot be reconciled with the model if reasonable vals. for the valency angle of S are assumed. The dependence on the ionic strength (μ) of the activity functions ϕ' and ϕ'', defined by $p\phi' = pK_a' - pK_c'$ and $p\phi'' = pK_a'' - pK_c''$, is considered. $p\phi'$ increases with increasing μ to a max. at μ ~0·5, and then decreases, in general becoming negative at μ >2·5. $p\phi''$ follows a similar course but the max. is at μ ~1·0. In a given salt solution $p\phi'' > p\phi'$, and in NaCl $p\phi''$ and $p\phi'$ are > in KCl at the same concn. The influence of constitution on the dependence of ϕ' and ϕ'' on μ is discussed. The results are compared with the theory of Scatchard and Kirkwood (A., 1932, 467) with good agreement for NaCl but not for KCl solutions.

F. J. G.

Determination of molecular b.p. elevations of inorganic and organic compounds in anhydrous hydrofluoric acid (water, deuterium oxide, potassium sulphate, potassium perchlorate, phenols, ketones, ethers). K. FREDENHAGEN and H. FREDENHAGEN [with E. KERCK and W. BEHRENDT] (Z. anorg. Chem., 1939, **243,** 39—59).—Mol. b.p. elevations in anhyd. HF have been determined for H_2O, D_2O, K_2SO_4, $KClO_4$, and a large no. of phenols, ketones, and ethers. H_2O and D_2O are considerably dissociated, the dissociation const. for H_2O being ~0·06. Earlier findings (A., 1939, I, 485) for K_2SO_4 and $KClO_4$ are confirmed. *o*- and *p*-$C_6H_4(OH)_2$ give ~1 mol., *m*-$C_6H_4(OH)_2$ (I), 1 : 2 : 3- and 1 : 3 : 4-$C_6H_3(OH)_3$ give ~2, and *s*-$C_6H_3(OH)_3$ gives ~4. All except (I) can be recovered unchanged from the solution. Aliphatic ketones give ~2 mols., aromatic ketones slightly >2. The ethers in general give 1·5—2·4 mols., the aliphatic ethers being rather more dissociated than the aromatic. Substitution of S for O leaves the degree of dissociation (α) unchanged or slightly increased; introduction of Cl or OH into Et_2O decreases it. α vals. for the mixed aromatic ethers are > for the corresponding phenols. Introduction of NO_2 increases α. In all cases the "dissociation" consists of the formation of F′ ions and complex cations by the union of protons with solute mols.

F. J. G.

Hydrolysis of stannous ion in stannous perchlorate solutions. M. GORMAN (J. Amer. Chem. Soc., 1939, **61,** 3342—3344).—The degree of hydrolysis of Sn˙˙ ion in aq. $Sn(ClO_4)_2$ containing free $HClO_4$ has been determined by measuring the mean ion

activity of total free $HClO_4$ and by an analysis of total [$Sn^{\cdot\cdot}$]. The mean activity of $H^{\cdot}$ and ClO_4' ions in the solutions was obtained from measurements at 25° of the cell Pt, H_2, $Sn(ClO_4)_2$, $HClO_4$|sat. NH_4NO_3|KCl (N.), Hg_2Cl_2, Hg. The variation of the equilibrium quotient with ionic strength proves that the hydrolysis follows the equation $Sn^{\cdot\cdot} + H_2O = SnOH^{\cdot} + H^{\cdot}$. The equilibrium const. K_1^0 is 0·02 at 25°. W. R. A.

[Heterogeneous equilibrium in binary mixtures with maximum vapour pressure.] R. Vogel (Z. physikal. Chem., 1939, **185**, 152; cf. A., 1939, I, 200).—Polemical against Jänecke (A., 1940, I, 26). J. W. S.

Phase equilibria in hydrocarbon systems. XXVII. Propane–*n*-butane system in the critical region. C. N. Nysewander, B. H. Sage, and W. N. Lacey (Ind. Eng. Chem., 1940, **32**, 118—123).—Data are presented in tabular and graphical form for the volumetric and phase behaviour of six C_3H_7–*n*-C_4H_{10} mixtures which have been investigated throughout the two-phase region at temp. >71°. C. R. H.

System *iso*propyl ether–*iso*propanol. H. C. Miller and H. Bliss (Ind. Eng. Chem., 1940, **32**, 123—125).—Vapour–liquid equilibrium data at 760 mm. for the system Pr^{β}_2O–$Pr^{\beta}OH$ are recorded. The system has an azeotrope corresponding with 78·2 mol.-% of Pr^{β}_2O, b.p. 66·15±0·05°. C. R. H.

High-pressure vapour–liquid equilibrium for systems propylene–*iso*butane and propane–hydrogen sulphide. E. R. Gilliland and H. W. Scheeline (Ind. Eng. Chem., 1940, **32**, 48—54).—Data are recorded in tabular and graphical form for the CHMe:CH_2–*iso*-C_4H_{10} system over all ranges of liquid composition and over pressures 200—600 lb. per sq. in., and for the H_2S–C_3H_8 system with low % of H_2S and over pressures 400—600 lb. per sq. in. Data for the first system, calc. from a fugacity equation applicable to high pressures, agree fairly well with experimental data at the lower pressures, but in the neighbourhood of the crit. region there are considerable discrepancies, the experimental vals. for the relative volatility being < vals. predicted from fugacities. A similar comparison in the case of the second system shows fair agreement, but the absence of experimental vals. near the crit. region minimises the val. of the comparison. An empirical method for calculating equilibrium data in crit. regions is developed. C. R. H.

System magnesium *n*-butyl bromide–magnesium bromide–ethyl ether. W. E. Doering and C. R. Noller (J. Amer. Chem. Soc., 1939, **61**, 3436—3437).—The system has been investigated at 25°. $MgBu^aBr$ greatly increases the solubility of $MgBr_2$. The mutual solubility of the Mg compounds exceeds their solubility in Et_2O. R. S. C.

Acetometallates. II. Acetozincate. A. Lehrman and P. Skell (J. Amer. Chem. Soc., 1939, **61**, 3340—3342; cf. A., 1938, I, 154).—Investigation of the liquidus curve of the system $Zn(OAc)_2$–NaOAc shows the existence of the compound $Na_2Zn(OAc)_4$. W. R. A.

Partial vapour pressures of water and ammonia from the system water–phosphoric acid–ammonia. C. S. Huey and H. V. Tartar (J. Amer. Chem. Soc., 1940, **62**, 26—32).—Partial pressures of NH_3 and H_2O at 25° over solutions of NH_3 in aq. H_3PO_4 have been measured by a static method. Similar measurements with $(NH_4)_2HPO_4$ solutions lead to a val. $8{\cdot}87 \times 10^{-3}$ for the hydrolysis const. of the salt. Dissociation pressures of NH_3 and H_2O over the temp. range 25—50° for the reaction $(NH_4)_3PO_4,3H_2O$ (*s*) $\rightleftharpoons$ $(NH_4)_2HPO_4$ (*s*) + $3H_2O$ (*g*) + NH_3 (*g*) and vals. of K_p, ΔG^0, ΔS, and ΔH have been deduced. W. R. A.

Equilibrium measurements on sodium silicates. E. Zintl and H. Leverkus (Z. anorg. Chem., 1939, **243**, 1—13).—Dehydration isothermals at 350—500° for mixtures of Na_2SiO_3 (I) and NaOH indicate the occurrence of the following reactions: (1) 2NaOH + (I) $\rightleftharpoons$ Na_4SiO_4 (II) + H_2O; (2) 2NaOH + 2(I) $\rightleftharpoons$ $Na_6Si_2O_7$ (III) + H_2O; (3) 2NaOH + (III) $\rightleftharpoons$ 2(II) + H_2O. Powder photographs show that no other compounds occur. The corresponding dissociation pressure curves intersect at 240 mm. and 402°, below which temp. (III) is unstable and breaks up into (I) and (II). From the curves, the reactions (1), (2), and (3) are exothermal from right to left, with heats of 12·0, 18·0, and 5·8 kg.-cal. respectively. F. J. G.

System $CoCl_2$–NH_4Cl–H_2O. A. Benrath and E. Neumann (Z. anorg. Chem., 1939, **243**, 174—184).—A no. of isotherms (0—100°) and the polytherm for the system are given. The colours and probable constitutions of alkali Co double chlorides in general are discussed. F. J. G.

Water in non-aqueous solutions. W. J. V. Osterhout and J. W. Murray (Science, 1939, **90**, 397—398).—When increasing amounts of $CCl_3{\cdot}CO_2H$ are added to a two-phase system of guaiacol (I) and H_2O in equilibrium at 25°, the concn. of H_2O in the (I) phase increases and its activity decreases. The activity of the (I) in the aq. phase also falls. Attraction of the acid for both (I) and H_2O is indicated. In diffusing through the (I) phase, $CCl_3{\cdot}CO_2H$ appears to carry H_2O with it. L. S. T.

Reciprocal salt pair $CoSO_4$ + $(KCl)_2$ = $CoCl_2$ + K_2SO_4. II. A. Benrath and G. Ritter (J. pr. Chem., 1939, [ii], **154**, 40—56).—A no. of isotherms at 0—100° have been determined for the ternary systems $CoCl_2$–KCl–H_2O, $CoCl_2$–$CoSO_4$–H_2O, and $CoSO_4$–K_2SO_4–H_2O. The existence at >50° of mixed crystals of $CoCl_2$,KCl,$2H_2O$ with excess of $CoCl_2$, and at >97° of the double *salt*, $CoSO_4$,K_2SO_4,$4H_2O$, is established. The results are combined with data already recorded (A., 1939, I, 323) to give the complete polytherm for the reciprocal salt pair. F. J. G.

Carbide studies by the methane-carbonisation method. III. [System Fe–Mn–C.] R. Schenck, K. Meyer, and K. Mayer (Z. anorg. Chem., 1939, **243**, 17—31; cf. A., 1938, I, 516).—Isothermals for the CH_4–H_2 equilibrium over Fe–Mn mixtures at 800° have been determined and a three-dimensional model for the system constructed. F. J. G.

Constitution of the system $SiO_2 + FeO + Fe_2O_3 + CaO$ (+ MgO). T. Négresco and W. J. Crook (Bull. Acad. Sci. Roumaine, 1936—37, **18**, 69—73).—The compounds which can be formed in the above system by fusion of the components at 1650° are described. The constitution of slags formed in steel manufacture is discussed. O. J. W.

Systems alkali oxide–CaO–Al_2O_3–SiO_2–CO_2. IX. Reaction behaviour of the different modifications of silica. C. Kröger and W. Graeser (Z. anorg. Chem., 1939, **242**, 393—405; cf. A., 1939, I, 420).—Reaction pressures of CO_2 over mixtures of an alkali carbonate with the various modifications of SiO_2 have been studied. Li_2CO_3 and cristobalite (I) give the same final pressures and reaction product (Li_2SiO_3) as Li_2CO_3 and quartz (II). (I) gives lower pressures than (II) with $CaCO_3$ and with $Na_2Ca(CO_3)_2$, these corresponding in the latter case with formation of $Na_2O,2CaO,3SiO_2$. With K_2CO_3 (I) and pptd. SiO_2 give higher pressures, and afford $K_2Si_2O_5$ more readily, than do (II) or tridymite. F. J. G.

Heat of formation of AgF_2. H. von Wartenberg (Z. anorg. Chem., 1939, **242**, 406—412).—By combustion of Ag in F_2 the heat of formation of AgF_2 has been determined as $84\cdot5\pm1\cdot2$ kg.-cal. per g.-mol. Comparison with the heat of formation of AgF and application of the Nernst heat theorem suggests that AgF_2 should have a dissociation pressure $\ll 1$ atm. at 1000°, whereas Ruff and Giese (A., 1934, 1080) find 1 atm. at 435°. It is shown experimentally that AgF_2 is stable at 700° under 0·1 atm. of F_2. Its m.p. is 690°. F. J. G.

Thermal data on organic compounds. XIX. Modern combustion data for some non-volatile compounds containing carbon, hydrogen, and oxygen. J. W. Richardson and G. S. Parks (J. Amer. Chem. Soc., 1939, **61**, 3543—3546; cf. A., 1938, I, 392).—Using a bomb calorimeter the heats of combustion at 25° and const. vol. ($-\Delta U_R$) have been measured for 2-$C_{10}H_7Me$ (I), o-$C_6H_4(CO)_2O$ (II), phthalic acid (III), anthracene (IV), phenanthrene (V), stilbene (VI), pyrene (VII), cetyl alcohol (VIII), and s-$C_6H_3Ph_3$ (IX) in the solid state, and n-hexadecane (X) and poly*iso*butylene (XI) in the liquid state. From these results the corresponding heats of combustion ($-\Delta H_R$) and heats of formation ($-\Delta H_f°$) at const. pressure (1 atm.) have been calc. $-\Delta U_R = 1382\cdot43\pm0\cdot52$ (I), $779\cdot04\pm0\cdot45$ (II), $770\cdot51\pm0\cdot32$ (III), $1683\cdot27\pm0\cdot58$ (IV), $1673\cdot47\pm0\cdot61$ (V), $1757\cdot02\pm0\cdot67$ (VI), $1871\cdot49\pm0\cdot84$ (VII), $2497\cdot04\pm0\cdot90$ (VIII), $2921\cdot83\pm1\cdot27$ (IX), $2551\cdot07\pm0\cdot97$ (X), $626\cdot95\pm0\cdot23$ (XI); $-\Delta H_R = 1383\cdot91$ (I), 778·74 (II), 770·21 (III), 1684·75 (IV), 1674·95 (V), 1758·80 (VI), 1872·97 (VII), 2501·78 (VIII), 2924·50 (IX), 2556·11 (X), 628·14 (XI); $-\Delta H_f° = -7\cdot99$ (I), 110·14 (II), 186·98 (III), −16·94 (IV), −26·74 (V), −32·47 (VI), −26·90 (VII), 164·11 (VIII), −52·92 (IX), 109·78 (X), 21·25 (XI) kg.-cal. per mol. W. R. A.

Vapour pressure of hydrated crystals of oxalic acid and sodium formate. S. Takagi and S. Oomi (J. Soc. Chem. Ind. Japan, 1939, **42**, 302—304B).—The v.p. of hydrated crystals of $H_2C_2O_4$ and of HCO_2Na have been determined between 0° and 50°. The following thermodynamic quantities are calc.: $H_2C_2O_4,3H_2O$ $\Delta F = 6660\cdot31$, $\Delta H_{298} = 26{,}149\cdot47$ g.-cal., $\Delta S_{298} = 65\cdot4$ e.u.; $HCO_2Na,2H_2O$ $\Delta F = 2345\cdot4$, $\Delta H_{298} = 9853\cdot5$ g.-cal., $\Delta S_{298} = 25\cdot2$ e.u.; $HCO_2Na,3H_2O$ $\Delta F = 4852\cdot77$, $\Delta H_{298} = 25{,}982\cdot1$ g.-cal., $\Delta S_{298} = 70\cdot88$ e.u. W. A. R.

Mixing entropy of systems containing long-chain compounds, and its statistical explanation. K. H. Meyer (Z. physikal. Chem., 1939, **B**, **44**, 383—391).—Data for 18 binary systems in which one component is a long-chain compound show that the partial mol. mixing entropy, ΔS_1, is in all cases $\gg$ the ideal val. The effect of intermol. forces is superposed on the ΔS_1 increase, since the deviations from ideal activity vals. in exothermic and endothermic systems are respectively < and > those for "athermic" systems, in which there is no change of heat content on mixing. The abnormality of ΔS_1 (*e.g.*, in the system PhMe–rubber) is attributed to a statistical reduction of the no. of possible arrangements of PhMe mols. due to the presence of the chains. The flexive motion of the chains accounts kinetically for the linear rise of reduced osmotic pressure (Π/c) with concn. (c) observed in certain cases. A. J. E. W.

Disperse structure of solid systems and its thermodynamic basis. D. Balarev and N. Kolarov (Kolloid-Z., 1939, **88**, 288—290; cf. A., 1939, I, 521).—When very pure cryst. KCl or KBr is heated for 6—48 hr. alternately at 300° and 500° the heat of dissolution is always slightly higher (temp. lowering smaller) after heating to the higher temp.; the changes of energy content at these two temp. are therefore reversible. F. L. U.

Heat capacity of nickel oxide from 68° to 298° K. and the thermodynamic properties of the oxide. H. Seltz, B. J. De Witt, and H. J. McDonald (J. Amer. Chem. Soc., 1940, **62**, 88—89).—C_p for NiO has been measured from 68·05° to 296·68° K.; the entropy is 8·36 entropy units. For the reaction $Ni(s) + \frac{1}{2}O_2(g) = NiO(s)$, $\Delta S_{298\cdot1} = -18\cdot00$, $\Delta H_{298\cdot1} = -58{,}400$, $\Delta G°_{298\cdot1} = -53{,}034$ g.-cal. W. R. A.

Determination of the thermodynamic scale of temperature below 1° K. by means of magnetic measurements. H. B. G. Casimir and W. J. de Haas (Physica, 1940, **7**, 70—78).—The errors involved in de Haas and Wiersma's method are discussed. Their magnitude can be estimated from the adiabatic M–H curves. L. J. J.

Dependence of conductance on field strength. D. J. Mead and R. M. Fuoss (J. Amer. Chem. Soc., 1939, **61**, 3589—3590).—Application of a correction to previous work (A., 1939, I, 525) on the dependence of the conductance of NBu_4 picrate in Ph_2O at 50° on field strength brings experimental data into exact agreement with theory. W. R. A.

Properties of electrolytic solutions. XXI. Conductance of tributylammonium picrate in ethylene chloride at 25°. D. J. Mead, R. M. Fuoss, and C. A. Kraus (J. Amer. Chem. Soc., 1939, **61**, 3257—3259; cf. A., 1937, I, 563).—The conductivity of $NHBu_3$ picrate in $(CH_2Cl)_2$ has been

measured at 25° for solutions $1\cdot8 \times 10^{-4} - 0\cdot5$N. Polarisation, indicated by the change of resistance with frequency, was observed in the more conc. solutions, and corrections for it have been applied.
W. R. A.

Effect of degree of dispersity on physico-chemical constants. VII. Effect of the dispersity of crystalline substances on the electrical conductivity of their saturated solutions. E. COHEN and J. J. A. BLEKKINGH, jun. (Proc. K. Akad. Wetensch. Amsterdam, 1940, **43**, 32—40).—The prep. of very pure $BaSO_4$ of known cryst. size is described. κ for the saturated solution at 25·00° is $4\cdot0$—$4\cdot5 \times 10^{-6}$ mho.
L. J. J.

Determination of transference numbers by e.m.f. methods. C. M. MASON and E. F. MELLON (J. Chem. Educ., 1939, **11**, 512—513).—Apparatus and method are described.
L. S. T.

Rôle of the electrons in certain physico-chemical phenomena. N. V. KARPEN (Bull. Acad. Sci. Roumaine, 1939, **22**, 117—129).—The equilibrium between electrode and solution is discussed on the basis of the theory that the electrons should be considered as an element capable of reacting with atoms, mols., and ions, and existing in equilibrium with these according to mass action law relationships. It is supposed that there is a definite electron concn. in the solutions, this being particularly high at high [OH′]. Electrode potentials are derived from the viewpoint of this theory, with particular reference to the Daniell cell, and it is shown that the relation $E = Q + T(\mathrm{d}E/\mathrm{d}T)$ is only approx. correct.
J. W. S.

Antimony electrode. Y. KAUKO and L. KNAPPSBERG (Z. Elektrochem., 1939, **45**, 760—769).—Details are given of results reported previously (A., 1939, I, 525), and work on the Sb electrode is reviewed.
J. W. S.

Zeolitic membrane electrodes. C. E. MARSHALL (J. Physical Chem., 1939, **43**, 1155—1164).—Preliminary investigations on the determination of p.d. with chabazite and apophyllite membranes are discussed. Their use for determining cationic activities appears to turn largely on the influence of the anion.
C. R. H.

Relative oxidation potentials of ketones.—See A., 1940, II, 90.

Theory for the passivity of chromium. (MISS) M. A. RYAN and H. HEINRICH (Trans. Electrochem. Soc., 1939, **77**, Preprint 10, 121—136).—The passivity is explained by the atoms on the face of each unit cube of Cr sharing their outer electrons to form a stable octet. Disturbance of this octet, by heating, scratching, passage of a.c., or by the presence of H ions, renders the metal active. In the presence of O or S, which with 6 outer electrons may take the part of Cr in the formation of the stable octet, the metal becomes passive.
D. F. R.

Double layer capacity at mercury electrodes. I. M. BARCLAY and J. A. V. BUTLER (Trans. Faraday Soc., 1940, **36**, 128—133).—Oscillograms of the charging curve of freshly-made Hg surfaces in contact with N-HCl and $-H_2SO_4$ comprise two approx. linear sections with change in direction at $E_h = \sim -0\cdot3$ v. The capacities of the electrode surface are $\sim$50 and $\sim$20 μF. per sq. cm. for $E_h > -0\cdot3$ and $< -0\cdot3$ v., respectively. The results obtained are in accord with those calc. from the electrocapillary curve and observations on the flow of current to an expanding Hg surface. Contrary to certain theories of overvoltage there is no evidence of H-deposition at $<$ the potential at which it is continuously evolved.
J. W. S.

Irreversible electrode phenomena of thallium. I. Hydrogen overvoltage in sulphuric acid. I. M. LEBARON and A. R. CHOPPIN (Trans. Electrochem. Soc., 1939, **77**, Preprint 11, 137—145).—The temp. coeff. is $-0\cdot0032$ v. per degree and is almost independent of [H˙] and of the c.d. The overvoltage is $\propto$ concn. at high c.d. but independent of concn. at low c.d. The data fit Bowden's mathematical derivations (A., 1930, 169).
D. F. R.

Formation of a deposit by electrophoresis. H. C. HAMAKER (Trans. Faraday Soc., 1940, **36**, 279—287; cf. A., 1939, I, 479).—When $BaCO_3$, $SrCO_3$, $BaSr(CO_3)_2$, MgO, $MgCO_3$, Al_2O_3, or CaF_2 is suspended in MeOH, EtOH, $COMe_2$, or mixtures of these liquids, coatings of the suspended material can be deposited electrophoretically on wire electrodes. Excepting at low voltages, short times, or very low concn. the amount deposited $\propto$ the time, electrode area, electric field, and concn. A method of determining the thickness and hence the apparent d of the layers is described, and the effects of experimental conditions on the apparent d are discussed.
J. W. S.

Oxidation–reduction potentials and mode of action of sulphanilamide. R. O. ROBLIN, jun., and P. H. BELL (Science, 1939, **90**, 327—329).—Measurements of the oxidation–reduction potentials obtained during the titration of 0·001M-sulphanilamide (I) with 0·001M-$Ce(SO_4)_2$ in presence of N-H_2SO_4 indicate that the "plateau potentials" of Shaffer (A., 1940, III, 59) are a function of the oxidised and reduced forms of the oxidising agent, and not of the oxidation products of (I). In presence of excess of (I), the potentials fall rapidly as the oxidised form of the oxidising agent is exhausted. Equilibrium potentials are established when partly oxidised solutions of (I) are kept for 48 hr. With excess of $Ce(SO_4)_2$, the equilibrium potentials are those of a $Ce^{\cdot\cdot\cdot\cdot}$–$Ce^{\cdot\cdot\cdot}$ system. The "plateau potentials" vary between wide limits, depending on the rate of addition of the oxidising agent.
L. S. T.

Potentiometric study of the formation of a double thallium silver arsenate. G. SPACU and C. DRĂGULESCU (Bull. Acad. Sci. Roumaine, 1939, **22**, 172—179).—If aq.-alcoholic $AgNO_3$, containing an excess of TlOAc or $TlNO_3$ and buffered with NaOAc, is titrated potentiometrically with Na_2HAsO_4, a rise in potential is observed when 1 mol. of arsenate has been added per 2 atoms of Ag, corresponding with the production of Ag_2TlAsO_4 (I) (cf. A., 1940, I, 125). Optimum results are obtained with a high [EtOH], when (I) is less sol. The rise in potential is also more marked when titration is carried out in conc. solution

and in the presence of a large excess of $Tl^{\cdot}$. The method is suitable for the determination of AsO_4'''.
J. W. S.

Reaction of hydrogen and deuterium atoms with propane. E. W. R. STEACIE and N. A. D. PARLEE (Canad. J. Res., 1939, **17**, **B**, 371—384).—Data and discussion on the reaction between H and C_3H_8 to form CH_4 and C_2H_6 previously reported (cf. A., 1939, I, 465) are amplified by calculations of collision yields etc. Additional data on the reaction between D and C_3H_8 are presented. The CH_4 formed is highly deuterised, especially at the higher temp. Deuterisation of C_2H_6 is absent at 30° but present at higher temp. Deuterisation of the initial C_3H_8 is $<0.5\%$. It appears likely that the mechanism of this deuterisation involves the formation and subsequent decomp. of quasi-methane and -ethane mols., viz., Me (Et) + D $\rightarrow$ MeD* (EtD*) $\rightarrow$ CH_2D (C_2H_4D) + H.
C. R. H.

Factors affecting flame velocity.—See B., 1940, 104.

Combustion processes in the Bunsen flame.—See B., 1940, 104.

Possible mechanism of the influence of pressure on chain gas reactions. E. V. STUPOTSCHENKO (Acta Physicochim. U.R.S.S., 1939, **11**, 555—570).—Theoretical. The propagation of a reaction chain may depend on the concn. in the neighbourhood of the chain of certain mols. which are intermediate products, so that their local concn. is not necessarily the average concn. The problem, and in particular the effect of pressure, is analysed from this point of view.
F. J. G.

Kinetics of reaction between carbon sulphoxide and ammonia. A. S. SELIVANOVA and J. K. SIRKIN (Acta Physicochim. U.R.S.S., 1939, **11**, 647—656).—The reaction between gaseous COS and NH_3 has been studied at 0—50°. It is heterogeneous, and approx. of the second order. The energy of activation is negative, $\sim$—2000 g.-cal. The steric factor is 10^{-7}—10^{-8}. Probably the first stage is $COS + NH_3 = SCONH_3$ (slow); then follows $SCONH_3 + NH_3 = NH_2{\cdot}CO{\cdot}SNH_4$ (I) (rapid). (I) disintegrates at $\sim$50° in two ways, affording $COS + 2NH_3$ and $CO(NH_2)_2 + H_2S$.
F. J. G.

Kinetic studies on iodine derivatives. I. Thermal decomposition of acetyl iodide. J. L. JONES (J. Amer. Chem. Soc., 1939, **61**, 3284—3288).—The main products of the thermal decomp. of AcI, studied from 290° to 340°, are CO, CH_4, I, and $(CH_2{:}CO)_x$ polymeride. The decomp. is unimol. with respect to AcI, and the rate coeffs. $\propto$ initial [I]. The rate coeff. is approx. const. in unpacked reaction vessels and in vessels packed with Pyrex tubing (increase in surface/vol. ratio from 0·72 to 5·10 cm.$^{-1}$), and 60% of the AcI is decomposed at 612° K. before a departure from first order is observed. The presence of inert gases (N_2, He) has little effect on the rate coeff. The data indicate a chain mechanism in the thermal decomp., and a scheme is proposed which involves the rupture of the C–I linking as the primary stage.
W. R. A.

Chain length and chain-ending processes in acetaldehyde decomposition. M. BURTON, H. A. TAYLOR, and T. W. DAVIS (J. Chem. Physics, 1939, 7, 1080—1085).—The val. 93 kg.-cal. given previously (A., 1939, I, 62) for the C–C bond strength in MeCHO is probably an over-estimate, and the correct val. may be as low as 75 kg.-cal. as calc. by Grahame. The chain-ending processes in the reactions: (i) pyrolysis, (ii) Me_2N_2-induced decomp., and (iii) photodecomp. of MeCHO are all bimol. Uncertain knowledge of the process (i), which is not the combination of Me radicals in the gas phase, leads to an uncertainty in Grahame's calculation. The processes (ii) and (iii) are not identical. In (iii), and possibly in (i), HCO is apparently involved, whilst the Ac radical seems to be concerned in (ii). Recombination of Me radicals to C_2H_6 may occur in packed vessels as a wall reaction.
W. R. A.

Kinetics of polyesterification. Effects of mol. wt. and viscosity on reaction rate. P. J. FLORY (J. Amer. Chem. Soc., 1939, **61**, 3334—3340).—The kinetics of two polyesterifications diethylene glycol (I)–adipic acid (II) and decamethylene glycol–(II) have been compared with those of (I)–$Bu^{a}CO_2H$, lauryl alcohol–(II), and lauryl alcohol–lauric acid, in which no polymerides are formed on esterification. The data indicate a great similarity between the natures of polyesterification and esterification, and their courses may be made to follow the same curve merely by multiplying all the time vals. of one of them by a suitable factor. This shows that reaction rate is unaffected by increase in mol. wt. and by increase in η, in agreement with theory. The order of the reactions increases continuously as the reaction proceeds, and finally becomes approx. third order. The slow rate of polyesterification when the average mol. wt. is large is due to third order esterification. Preliminary data are recorded on the reaction of (I) with (II) catalysed by p-$C_6H_4Me{\cdot}SO_3H$.
W. R. A.

Polymerides. IV. Determination of the constants of polymerisation. F. MAREI (Acta Physicochim. U.R.S.S., 1939, **11**, 549—554; cf. A., 1939, I, 203).—Theoretical. The velocity coeffs. for the breaking and growth of chains can be calc. from observations on the time-dependence of the degree of polymerisation. Vals. obtained from published data on styrene are given. The activation energies are respectively 20,000 and 10,000 g.-cal. F. J. G.

Excitation of chain polymerisation by free radicals. II. G. V. SCHULZ (Naturwiss., 1939, **27**, 659—660; cf. A., 1939, I, 422).—The polymerisation of styrene by $CPh_3{\cdot}N{:}NPh$ (I) has been investigated. (I) decomposes at 60° at a readily measurable velocity into $CPh_3^{\cdot}$ and Ph. At concns. $<3 \times 10^{-5}$ mols. of (I) per mol. of styrene, about 1 mol. of polystyrene was formed per mol. of (I). At greater concns. part of the radicals is used in a side-reaction occurring between the free radicals themselves. The mechanism of the process is considered. A. J. M.

Hydrolysis of bromine. Hydration of the halogens. Mechanism of certain halogen reactions. H. A. LIEBHAFSKY (J. Amer. Chem. Soc., 1939, **61**, 3513—3519).—Introduction of corrections

into earlier data on Br hydrolysis adds further support to the hypothesis that the anomalous temp. coeffs. associated with aq. halogen solutions result from shifts in the hydration equilibria. For the H_3AsO_3–I reaction $-d[I_3']/dt = k_3'[I_3'][H_3AsO_3]/[H^{\cdot}][I']^2$, and the heat of activation is 16,970 kg.-cal. per mol. Anomalies in the temp. coeffs. of processes in aq. I solutions have no counterpart in the absorption of visible light by these solutions. The spectrophotometric differences between gaseous I in air and I dissolved in CCl_4 on the one hand, and aq. I solutions on the other, are described. W. R. A.

Kinetics of the reaction between potassium persulphate and the alkyl iodides. I. Influence of solvents, acids, and salts. M. S. TELANG and V. V. NADKARNY (J. Indian Chem. Soc., 1939, **16**, 536—542).—The solvent effect of ROH, $R'CO_2H$, and $R'CO_2R$ on the velocity of the reaction between EtI and $K_2S_2O_8$ alternates in ascending the homologous series; the relation between the effect and the dipole moment is discussed. The salt effect is $H^{\cdot} > K^{\cdot} > NH_4^{\cdot} > Na^{\cdot}$ in the same order as the transport nos. The order of catalytic influence of mineral acids runs parallel with that of their ionisation consts. F. R. G.

Critical increment of ionic reactions. IV. Influence of dielectric constant and ionic strength. L. RAMPINO and W. J. SVIRBELY. **V. Influence of dielectric constant and ionic strength.** W. J. SVIRBELY and J. LANDER (J. Amer. Chem. Soc., 1939, **61**, 3534—3537, 3538—3542; cf. A., 1938, I, 463).—The conversion of NH_4CNO into $CO(NH_2)_2$ from 30° to 60° in isodielectric aq. $Pr^{\beta}OH$ solutions over a dielectric range of 63·5 to 20 has been investigated. The effect of the ionic strength on the crit. increments observed at zero ionic strength agrees well with the equations previously derived. The crit. increment is apparently independent of the dielectric const. in isodielectric mixtures for the greater part of the range studied. From $D = 63{\cdot}5$ to 40, $(\Delta k_0/\Delta D)_T = -0{\cdot}52(\Delta k_0/\Delta T)_D$, where k_0 is the limiting velocity coeff. At the higher vals. of D, the influence of D of the solvent on the rate coeff. agrees with the Scatchard–Christiansen theory. The collision factor Z varies with D. The collision theory and the thermodynamic treatment agree for the higher dielectrics.

V. The rate of conversion of NH_4CNO into $CO(NH_2)_2$ has been studied from 30° to 60° in isodielectric mixtures of dioxan and H_2O over a range $D = 63{\cdot}5$ to 5. The effect of ionic strength on the observed crit. increments at zero ionic strength agrees with theory. The crit. increment first decreases with D, and then increases at $D \simeq 20$. From $D = 63{\cdot}5$ to 35, $(\Delta k_0/\Delta D)_T = -0{\cdot}61(\Delta k_0/\Delta T)_D$. The influence of D upon the rate coeff. is in fairly good agreement with the Scatchard–Christiansen theory at higher vals. of D. The val. of the collision factor Z varies with D, especially at lower vals. of D. Agreement between the collision theory and the thermodynamic treatment of higher isodielectric mixtures is good. W. R. A.

Rates of the thermal reduction of dichromic acid by quinine, hydroquinine, and cinchonine in dilute sulphuric acid at 0° to 60°. L. J. HEIDT (J. Amer. Chem. Soc., 1939, **61**, 3455—3458).—The rates of the thermal oxidation of quinine, hydroquinine, and cinchonine by $H_2Cr_2O_7$ in 1·55M-H_2SO_4 are approx. const. The initial rates of the reactions, which are autocatalytic, are expressed by $-\Delta[K_2Cr_2O_7]/\Delta t = k[K_2Cr_2O_7][\text{alkaloid}]^{\frac{1}{2}}$; $\log_{10} k = 4{\cdot}05 - 2000/T$, k being expressed as (kg. solution)$^{\frac{1}{2}}$ mol.$^{-\frac{1}{2}}$ min.$^{-1}$ The initial photochemical reaction, which is also autocatalytic, is expressed by $-\Delta[K_2Cr_2O_7]/\Delta t = k^*[K_2Cr_2O_7]^{\frac{1}{2}}$, in which k^* varies with the temp., the structural differences in the alkaloids, and the λ and intensity of monochromatic light absorbed by the alkaloids. Light absorbed by the other reactants has no effect on the reaction. The independence of the photochemical rate on alkaloid concn. suggests that one mol. of alkaloid enters the reaction. Comparison of the data indicates that the light effective in the photochemical reaction initiates a reaction different from that which takes place on the absorption of thermal energy alone. W. R. A.

Rates of reaction of *cyclo*propyl ketimines with water.—See A., 1940, II, 90.

Mechanism of ester hydrolysis and ester formation.—See A., 1940, II, 63.

Hydrogen exchange reactions of esters in relation to reactivity in condensation reactions. W. G. BROWN and K. EBERLY (J. Amer. Chem. Soc., 1940, **62**, 113—115).—The H exchange reactions of Et esters of AcOH, $EtCO_2H$, $Pr^{\alpha}CO_2H$, $Pr^{\beta}CO_2H$, $Bu^{\beta}CO_2H$, lauric, stearic, *cyclo*hexylacetic, α-methoxypropionic, crotonic, sorbic, ββ-dimethylacrylic, citraconic, mesaconic, *o*- and *p*-$C_6H_4Me{\cdot}CO_2H$, 2 : 4 : 6-$C_6H_2Me_3{\cdot}CO_2H$, $CH_2Ph{\cdot}CO_2H$, $CHPh_2{\cdot}CO_2H$, α-methoxyphenylacetic, $CHPhMe{\cdot}CO_2H$, malonic, methyl- and phenyl-malonic acids with EtOD catalysed by NaOEt have been investigated. The influence of structure on acidity, as determined by the exchange reaction, is correlated with reactivity in condensation reactions. W. R. A.

Kinetics of saponification of methyl acetate in dioxan–water mixtures at 25°. T. HUANG and H. HSIEH (J. Chinese Chem. Soc., 1939, **7**, 13 pp.).—The velocity coeff. for the hydrolysis of 0·01N-MeOAc by 0·01N-NaOH at 25° in dioxan–H_2O mixtures is given by $k = 11{\cdot}8 + 69x$ where x = mol. fraction of dioxan, over the range 0—30% dioxan. At higher dioxan concn. the results become erratic. F. J. G.

Velocity of hydrolysis of ethers. R. SKRABAL (Z. physikal. Chem., 1939, **185**, 81—96).—The velocities of hydrolysis of $CH_2{:}CH{\cdot}OEt$, $CH_2{:}CH{\cdot}OPr^{\beta}$, $CH_2{:}CH{\cdot}O{\cdot}CH_2{\cdot}CH{:}CH_2$, $(CH_2{:}CH{\cdot}CH_2)_2O$, $CH_2{:}CH{\cdot}CH_2{\cdot}OEt$, and $CH_2{:}CH{\cdot}CH_2{\cdot}OPr^{\beta}$ have been determined in NaOAc–AcOH buffer solutions at 15°, 25°, and 35°. The influence of each alkyl group is described by two factors, which permit the accurate calculation of the velocity of hydrolysis of any ether provided that the velocity coeffs. of other ethers containing the same alkyl groups are known. J. W. S.

Reaction between acetylene dimagnesium dibromide and carbonyl compounds.—See A., 1940, II, 8.

Kinetics of phase change. I. General theory. M. AVRAMI (J. Chem. Physics, 1939, 7, 1103—1113).—A theory of the kinetics of phase change which has been developed assumes that the new phase grows from the presence in the old phase of germ nuclei, the no. of which can be changed by previous treatment, *e.g.*, temp. and duration of superheating. These nuclei may be heterogeneities of any type, foreign particles with an adsorbed layer of the new phase, or small " blocks " or " crystal mols." of the new phase (if solid). The density of germ nuclei decreases owing to activation of some of them to become growth nuclei for grains of the new phase, and to removal of others by these growing grains. Quant. relations between the density of germ nuclei, growth nuclei, and transformed vol. have been derived and expressed as a characteristic time scale for any given substance and process. From this viewpoint, a study of the geometry and kinetics of a cryst. aggregate indicates the existence of an isokinetic range of temp. and concns. for any given substance, in which the characteristic kinetics of phase change remain the same. Some general properties of temp.–time and transformation–time curves are described and explained. W. R. A.

Rate of oxidation of cobaltous oxide to the saline oxide. (MME.) G. CHAUVENET (Compt. rend., 1939, **209**, 886—887).—The wt. of O_2 (pressure 760 mm.) absorbed after t hr. by discs (surface s sq. cm.) of CoO at 500—750°, giving Co_3O_4, is $571st^{\frac{1}{2}}e^{-11975/T}$ g. This expression corresponds with that for oxidation of Co to CoO (cf. A., 1937, I, 571; 1938, I, 523). A. J. E. W.

Rate of formation of *m*-nitroaniline hydrochloride. (MME.) D. MARKOWSKA (Compt. rend., 1939, **209**, 879—881; cf. A., 1939, I, 477).—The fraction (m) of m-$NH_2{\cdot}C_6H_4{\cdot}NO_2$ (mean particle diameter e_0) converted into the hydrochloride by HCl (pressure p) in t hr. is given by: $5{\cdot}3215 - (1 - m)^{\frac{2}{3}} - 4{\cdot}3215(1 + 0{\cdot}2314m)^{\frac{2}{3}} = Kt/e_0{}^2$; K is determined by temp., p, etc. The rate is min. at 30—40°, and the reaction is of the second order with respect to p. A. J. E. W.

Reactions of the type $A_{\text{solid}} + B_{\text{gas}} \rightarrow C_{\text{solid}}$ and the kinetics of the neutralisation of solid benzoic acid by gaseous ammonia. (MME.) D. MARKOWSKA and G. VALENSI (Bull. Soc. chim., 1939, [v], 6, 1522—1541).—The previously derived general expression (A., 1935, 1466) is extended to the general case of gases reacting with solids to yield solid products. The law is confirmed by measurements of the rate of reaction of NH_3 with needle crystals of BzOH. The velocity of this reaction passes through a max. at 30—40° and is approx. $\propto p^{0{\cdot}6}$. J. W. S.

Exchange of hydrogen atoms between pyrrole, indole, and its methyl derivatives and water. VI. Exchange between 2- and 3-methylindole and 2 : 3-dimethylindole and water. VII. Exchange between indole and indene and water in alkaline solution. M. KOIZUMI (Bull. Chem. Soc. Japan, 1939, 14, 453—461, 491—500; cf. A., 1938, I, 318).—VI. 2-Methylindole possesses two easily exchangeable H atoms and consequently 2 : 3-dimethylindole can have only one. The exchange equiv. of 3-methylindole is slightly > that of 2-methylindole at high p_H but becomes much greater at low p_H.

VII. With indole a H atom attached to a ring C is exchanged for the D atom and not a H atom attached to the N. The reaction in fairly alkaline solution is much faster than in acid solution and does not appear to take place in stages but increases with increasing alkalinity. Indene gives similar results and it is concluded that the exchange mechanism in alkaline solution is different from that in acid and resembles much more closely an acid–base catalytic reaction. T. H. G.

Kinetic investigations of highly polymerised compounds (polyoxymethylene and cellulose). J. LÖBERING (Kolloid-Beih., 1939, **50**, 235—366).—A detailed account of experiments on the kinetics of degradation and dissolution (cf. A., 1939, 476, 32, and previous abstracts). F. L. U.

Mechanism of the acid-catalysed dimerisation of anethole. W. G. BROWN and A. H. WIDIGER (J. Amer. Chem. Soc., 1940, **62**, 115—116).—The dimerisation of anethole catalysed by HCl + DCl in MeOH is accompanied by a slow H exchange reaction of the monomeride and dimeride. The dimeride contains D $\ngtr$ can be accounted for by this exchange. The data do not support any mechanism involving an intermediate carbonium ion (or additive compound) in which the equivalence of the newly acquired H atom with H atoms previously present on the same C is assumed. W. R. A.

Decomposition of hydrogen peroxide by catalase. D. KEILIN and E. F. HARTREE (Nature, 1939, **144**, 1091; cf. A., 1940, I, 32).—The authors' view of the mechanism is re-affirmed, and evidence for its validity summarised. L. S. T.

Autoxidation of benzaldehyde in presence of 7 : 8-diphenylacenaphthylene.—See A., 1940, II, 45.

Constitutive factors in the acid hydrolysis of esters of aliphatic carboxylic acids.—See A., 1940, II, 64.

Organic catalysts for removal of carbon monoxide from formamide. II.—See A., 1940, II, 71.

Catalytic interaction of acetylene and hydrogen on platinum. A. FARKAS and L. FARKAS (J. Amer. Chem. Soc., 1939, **61**, 3396—3401).—The catalytic hydrogenation of C_2H_2 has been investigated on a Pt catalyst from 20° to 140°, and 70 to 150 mm. pressure, using the technique described previously (A., 1938, I, 149). The rate of hydrogenation increases with increasing [H_2], but decreases with increasing [C_2H_2], the inhibition of hydrogenation by C_2H_2 being similar to, but >, that of the hydrogenation of C_2H_4 by [C_2H_4]. An accelerated hydrogenation observed at some stages of the hydrogenation is due to removal of C_2H_2, and to the fact that the rate of the hydrogenation of C_2H_4, which occurs in the second half of the reaction, is $\gg$ the rate of formation of C_2H_4. From experiments in which p-H_2 is used instead of H_2, it is deduced that the o–p conversion is $\ll$ in the absence of C_2H_2. The dependence of the

hydrogenation on temp. was not accurately determinable owing to the deactivation of the catalyst, especially at the higher temp., but an approx. val. of 12 to 27 kg.-cal. per mol. has been obtained for the hydrogenation of C_2H_2. The ratio of the rate of hydrogenation of C_2H_2 by H_2 to that by D_2 is 1·5 at 20°. The rate of catalytic exchange of H atoms between C_2H_2 and D_2 is $\ll$ that between C_2H_4 and D_2 under similar conditions. The data indicate that C_2H_2 is strongly adsorbed on the catalyst surface and C_2H_2 can displace both H_2 and C_2H_4 in the adsorption layer. The mechanism of hydrogenation and exchange reactions is discussed. W. R. A.

Influence of the nature of the substituent on the velocity of catalytic hydrogenation of certain trisubstituted ethylenes in presence of platinum.—See A., 1940, II, 2.

Mercury compounds as catalysts of the synthesis of aspartic acid from fumaric acid and ammonia.—See A., 1940, II, 70.

Active substances. XLI. Characterisation of transition of amorphous hydrated ferric oxide to α-ferric oxide by sorption and catalytic measurements. R. FRICKE and H. WIEDMANN (Kolloid-Z., 1939, **89**, 178—184; cf. A., 1935, 1204).—Specimens of amorphous hydrated Fe_2O_3 preheated at temp. from 20° to 300° were used in measurements of CO_2 adsorption, rate of decomp. of H_2O_2, and hygroscopicity. The changes in the respective properties with the temp. of preheating are related to the transformation into α-Fe_2O_3 as revealed by *X*-ray examination. F. L. U.

Formation of amino-aldimine complexes by hydrogenation of amino-nitriles in presence of nickel.—See A., 1940, II, 90.

Contact sulphuric acid manufacture. XX, XXI.—See B., 1940, 128.

Catalysts for synthesis of liquid hydrocarbons from carbon monoxide and hydrogen. VIII, IX.—See B., 1940, 113.

Induced pyrolysis of methane.—See B., 1940, 113.

[Catalytic] synthesis of methyl alcohol from carbon dioxide and hydrogen.—See B., 1940, 114.

Catalytic dissociation and synthesis of methyl alcohol [on zinc oxide].—See B., 1940, 114.

Formation of methane from carbon monoxide–hydrogen mixtures.—See B., 1940, 113.

Catalyst for production of acetaldehyde from acetylene.—See B., 1940, 114.

Catalyst for production of acetic acid from acetylene.—See B., 1940, 114.

Experiments showing the directional reactivities of single crystals of copper. A. T. GWATHMEY and A. F. BENTON (Trans. Electrochem. Soc., 1939, **77**, Preprint 9, 113—120).—A small highly-polished sphere prepared from a single Cu crystal was used. Amalgamation with Hg is most rapid at the poles of the (111) planes. O_2 bubbled through 50% AcOH in H_2O produces etch patterns first at the (100) poles and later at the (111) and (110) poles. Dissolution in H_2CO_3 is restricted to the atoms in surfaces parallel to the (111) planes. Etch patterns obtained electrolytically are affected by the nature of the electrolyte but not in general by the concn. or c.d. Electrolytic etching in H_3PO_4 is more rapid at the (111) poles than at the (100) poles. D. F. R.

Electrolytic preparation of copper–zinc–nickel alloy.—See B., 1940, 143.

Electrolytic nitration of aromatic hydrocarbons. I—III.—See A., 1940, II, 39.

Photochemical decomposition of solid hydrogen compounds at low temperatures. L. FARKAS, Y. HIRSHBERG, and L. SANDLER (J. Amer. Chem. Soc., 1939, **61**, 3393—3396).—*p*-H_2 is formed when solid HI is irradiated at from 65° to 85° K. To test the possibility of a secondary *o*-*p* conversion taking place after the illumination, normal H_2 was introduced into the reaction vessel. No *p*-H_2 was formed in the presence of HI crystals. The *p*-H_2 formation may be due to (i) the conversion of the normal H_2 formed initially into *p*-H_2 by the paramagnetic action of free I atoms, and (ii) the reaction $H + HI \rightarrow H_2 + I +$ 30,000 g.-cal., the heat of the reaction being completely taken up by the HI lattice. In the photolysis of MeOH and CH_2O under similar conditions, normal H_2 is produced. The absence of *p*-H_2 indicates that the primary process may be $CH_2O + h\nu \rightarrow H_2$ (or 2H) + CO, MeOH + $h\nu \rightarrow CH_2O + H_2$ (or 2H), in which the two atoms forming H_2 must come from the same mol. W. R. A.

Thermal and photochemical exchange reactions of bromine. J. N. WILSON and R. G. DICKINSON (J. Amer. Chem. Soc., 1939, **61**, 3519—3520).—A rapid exchange of Br′ ions occurs when $AsBr_3$ (or $SnBr_2$) is mixed with a CCl_4 solution of Ra-Br′ ions at room temp., but no exchange was observed with either $(CH_2Br)_2$ or CCl_3Br (I) in the same solvent at 100° in the dark. Green light (5000—6100 A.) induces exchange with (I) at 76°. W. R. A.

Mechanism of photochemical decomposition of nitrosyl chloride. G. L. NATANSON (Acta Physicochim. U.R.S.S., 1939, **11**, 521—536).—A study of the kinetics of the photochemical decomp. of NOCl has confirmed Kistiakowsky's finding (A., 1930, 306) that the quantum yield is ~2, and has shown that it does not change on addition of a fifty-fold excess of N_2 or CO_2, or on lowering p_{NOCl} to 7·2 mm. This is not easily reconciled with Kistiakowsky's suggested mechanism. Moreover a study of the absorption spectrum in the region 630—400 mμ. does not confirm Kistiakowsky's finding of a discrete structure in the region <530 mμ., and it is suggested that this was due to traces of NO_2. Accordingly it is suggested that the reaction does not involve an excited mol., but takes place by primary dissociation, occurring directly at <530 mμ., and by predissociation at 630—530 mμ. The possibility of vibrational predissociation is discussed. The proposed mechanism is $NOCl + h\nu = NO + Cl$, followed by $Cl + NOCl = NO + Cl_2$. F. J. G.

Silver in the photographic process. K. SCHAUM (Kolloid-Z., 1939, **89**, 211—214).—A discussion of

the mode of formation of Ag nuclei and of their transformation into cryst. Ag (cf. B., 1937, 90).

F. L. U.

Mechanism of formation and development of the latent photographic image. P. D. DANKOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 773—778).—An explanation of the formation of the latent image is suggested in terms of the author's theory of orientational and directional conformity (cf. B., 1939, 1049) whilst the development of the image is discussed from the point of view of the electronic theory of metals and the principles of conformity. Explanations are also given of Herschel's and Weigert's effects. The possibility of applying the author's theory to photochemical changes in solids has been demonstrated. T. H. G.

Photochemical formation of trichlorobromomethane from chloroform and bromine. V. BRAUNWARTH and H. J. SCHUMACHER (Kolloid-Z., 1939, **89**, 184—194).—The photobromination of $CHCl_3$ has been studied in light of λ 546 mμ., in the vapour phase at 130°. The influence of total pressure, light intensity, [$CHCl_3$], [Br_2], [HBr], and [CCl_3Br] on the velocity is shown in tables. The temp. coeff. (110—130°) is 1·35, corresponding with an activation energy of ~10 kg.-cal. for the total reaction. The quantum yield with $CHCl_3$, Br_2, and HBr each at 100 mm., and with light absorbed at the rate of $1{\cdot}5 \times 10^{15}$ $h\nu$ per c.c per min., is 19 mols./$h\nu$. The reaction takes place in a manner similar to that previously found for $H_2 + Br_2$ and for $CHCl_3 + Cl_2$ (cf. A., 1934, 740, 1316; 1937, I, 91). F. L. U.

Photochemistry of di-iodoacetylene and tetra-iodoethylene. J. W. TAMBLYN and G. S. FORBES (J. Amer. Chem. Soc., 1940, **62**, 99—104).—The photoiodination of C_2I_2 in C_6H_{14} in absence of O_2, studied quantitatively in red and blue light, proceeds by a chain reaction with the quant. formation of C_2I_4. A general equation is given representing the kinetics, which includes factors dependent on the λ of the light employed. A sp. rate coeff., obtained by integration, is valid for any λ. The photolysis of C_2I_2 in C_6H_{14} is complicated by polymerisation. C_2I_4 in C_6H_{14} photolysed by ultra-violet light (254 mμ.) gives initially one mol. of free I_2 for each mol. of C_2I_4 which disappears, and the quantum yield is 0·8. In later stages of photolysis an unidentified product was obtained. W. R. A.

Reactions of the leucocyanides of the triphenylmethane dyes. I. Mechanism of the dark reaction following the photolysis of malachite-green leucocyanide. F. E. E. GERMANN and C. L. GIBSON (J. Amer. Chem. Soc., 1940, **62**, 110—112).—Solutions of malachite-green leucocyanide (I) in EtOH containing some H_2O (5×10^{-5}M.) were illuminated for from 1 to 15 hr. and then allowed to fade in a dark room for $\nless$1 week. The end-product is colourless, and has a peak in the absorption curve at ~3600 A., indicating that it is not (I), the leucocarbinol, or the photo-compound, since the absorption max. of these are at ~3500 A. It is formed more easily as the [H_2O] increases, but is unstable at $\gg$15% H_2O. It is less stable than (I), being decomposed by dil. HCl or excess of H_2O, giving the coloured malachite-green ion. This ion is also produced by ultra-violet irradiation. These properties indicate that the end-product of the dark reaction is produced from interaction of the solvent and the malachite-green ion, and, in agreement with the mechanism of Villiger and Kopetschni (A., 1912, i, 1030), may be the ether form. W. R. A.

***X*-Ray sensitivity of liquid water and ice.** P. GÜNTHER and L. HOLZAPFEL (Z. physikal. Chem., 1939, **B**, **44**, 374—382).—The formation of H_2 during irradiation of H_2O by X-rays at 22—29° is confirmed; the H_2 has been determined by measuring the residual pressure ($1—4 \times 10^{-3}$ mm.) in a closed system after distilling the irradiated H_2O into a trap cooled in liquid H_2. The H_2 produced is approx. $\propto$ the time of irradiation, and the yield (~1 mol. per ion-pair) corresponds with those for the Xe-sensitised X-ray photolysis of H_2O vapour (cf. A., 1939, I, 88, 330), and decomp. of H_2O by α-rays (Lanning and Lind, *ibid.*, 90). No H_2 formation can be detected during irradiation of ice at −180°. A. J. E. W.

Action of radon on polymethylenes. *cyclo*-Butane and *cyclo*butene. G. B. HEISIG (J. Physical Chem., 1939, **43**, 1207—1212).—The polymerisation of *cyclo*-butane and -butene by α-rays from Rn has been demonstrated. C. R. H.

Hydrogen peroxide and its derivatives. IV. Preparation of pure D_2O_2. F. FEHER (Ber., 1939, **72**, [*B*], 1789—1798).—An all-glass apparatus for the prep. of 100% D_2O_2 is described in which D_2O vapour is blown through a mixture of D_2SO_4 and KSO_4 maintained at ~70—90°. The mixture of D_2O and D_2O_2 vapour escaping in a vac. is fractionally condensed and the condensate which is enriched in active O is conc. by fractional distillation. The dil. peroxide solution obtained by the condensation or distillation is automatically returned to the starting point and is again sent through the D_2SO_4–KSO_4 mixture. The process is continued until the requisite amount of 100% D_2O_2 has been obtained. The [D_2O_2] present at any instant is determined by a series of glass floats. HDO_2 is synthesised from 100% H_2O_2 and 100% D_2O_2. The apparatus is suited to the prep. of 100% H_2O_2 if a very pure product is required; considerable simplification is possible since H_2O is available in sufficient amount. H. W.

Sodium polyphosphates. (A) H. HUBER. (B) K. R. ANDRESS (Z. anorg. Chem., 1939, **243**, 110—111, 112).—(A) The work of Andress and Wüst (A., 1938, I, 319; 1939, I, 379), particularly their use of determination of "Ca-binding power" as an analytical method, is criticised.

(B) A reply. F. J. G.

Thermal decomposition of sodium and potassium nitrate. K. LESCHEWSKI [with W. DEGENHARD] (Ber., 1939, **72**, [*B*], 1763—1766).—The thermal decomp. of $NaNO_3$ into $NaNO_2$ and O_2 proceeds slowly until at >360° distinct evolution of O_2 is visible. Large amounts of O_2 may be vigorously evolved at a low temp.; this depends on the material of the vessel and usually subsides rapidly. The formation of Na_2O commences at 520° and that of K_2O at 550°. Occasionally the formation of Na_3NO_3

is betrayed by the colour of the mass. Between 600° and 620° brown oxides of N, which dissolve completely in KOH, are evolved in relatively small amount. N_2O could not be detected with certainty. Above 650° $NaNO_3$ gives small amounts of $NaNO_2$, usually containing traces of Na_2O, as a white sublimate which can be obtained in greater amount when somewhat moist $NaNO_3$ is rapidly heated at >800°. The behaviour of KNO_3 is closely similar. Above 750° for $NaNO_3$ and 850° for KNO_3 the formation of peroxide is obvious ($NaNO_3 + Na_2O = NaNO_2 + Na_2O_2$). At 1250° peroxide is no longer present. A combination of thermal and chemical (Lunge's reagent) analysis proves that the decomp. of $NaNO_3$ into $NaNO_2$ begins at 255° and of KNO_3 into KNO_2 at 286° in glass vessels if only a small amount of material is used. A nitrogenous compound remains at >800°; this does not give oxides of N when treated with acid and is reduced by Devarda's alloy to NH_3. Examination of the residues and volatile products from $NaNO_3$ and KNO_3 at >600° shows that the individual processes of decomp. do not follow one another stepwise and cannot be separated from one another in their course. H. W.

Hydrosulphides and hydroselenides of the alkali metals. W. Teichert and W. Klemm (Z. anorg. Chem., 1939, **243**, 86—98).—*Na, K, Rb,* and *Cs hydroselenides* have been obtained in a state of purity by the action of H_2Se on the ethoxides in anhyd. EtOH, H_2O and O_2 being excluded. The findings of West (A., 1934, 1161) for the crystal structures of the alkali hydrosulphides are completely confirmed, and analogous results for the hydroselenides have been obtained, viz., the Na, K, and Rb compounds have a rhombohedrally distorted NaCl structure at room temp., and the NaCl structure at higher temp., and CsSeH has the CsCl structure. Lattice consts. are given. The radii of the SH′ and SeH′ ions are respectively 1·98 and 2·11 A., and mol. vol. increments at 0° K. are 24·5 and 29, respectively. F. J. G.

Compounds of sulphates of bivalent heavy metals with quinoline. T. Chang and W. Yü (Z. anorg. Chem., 1939, **243**, 14—16; cf. A., 1939, I, 380).—The following *quinoline salts* are described: $2CuSO_4,5C_9H_7N$, m.p. 100° (decomp.); $2CuSO_4,C_9H_7N$, m.p. 155° (decomp.); $2CoSO_4,C_9H_7N$, m.p. 141° (decomp.); $2HgSO_4,C_9H_7N$, m.p. 155° (decomp.). F. J. G.

Two new compounds: silver thallium phosphate and arsenate. G. Spacu and P. Spacu (Bull. Acad. Sci. Roumaine, 1939, **22**, 147—149).—When a solution of $Na_2HPO_4,12H_2O$ (0·45 g.) in H_2O (40 c.c.) is treated with TlOAc (0·6 g.) in H_2O (20 c.c.), and the mixture stirred during addition of $AgNO_3$ (0·3 g.) in H_2O (20 c.c.), *Ag Tl phosphate*, Ag_2TlPO_4, is obtained as a white ppt. After separation, it can be washed with H_2O and then dried by washing with EtOH and Et_2O. It is sol. in hot dil. H_2SO_4 and in dil. HNO_3. It is not decomposed by hot aq. NH_3 but alkali hydroxides cause it to turn black owing to separation of Ag_2O. Similar treatment of $Na_2HAsO_4,7H_2O$ (0·6) in H_2O (40 c.c.) with TlOAc (0·8 g.) in H_2O (20 c.c.) and then with $AgNO_3$ (0·4 g.) in H_2O (20 c.c.) yields a white ppt. of *Ag Tl arsenate*, Ag_2TlAsO_4; it resembles Ag_2TlPO_4 in its behaviour towards acids and alkalis. J. W. S.

Action of vapours on metals. R. Dubrisay (Bull. Soc. chim., 1939, [v], **6**, 1549—1557).—The attack of Ag by S vapour is accelerated by evacuation of the containing vessel, this effect being attributed to an increase in the rate of diffusion of the vapour and to the removal of adsorbed gases from the Ag. The attack on the metal is retarded by very low pressures of vapours (C_5H_{11}·OH, PhOH, camphor, and anthracene) which are adsorbed by Ag. If bulbs of S and Hg are introduced into the limbs of an inverted U-tube, which is evacuated, and the two bulbs are broken together or the Hg bulb is broken first, a black deposit forms on the S but the Hg is not tarnished, whereas if the S bulb is broken some time before the Hg bulb the Hg is tarnished but the S remains yellow. This effect is attributed to the different rates of vaporisation and of diffusion of the two elements. When a Cu sheet is arranged in the horizontal arm of a T-tube, the vertical limb of which contains S or I, periodic coloured rings form on the lower face of the Cu and curved lines on the upper face. These are attributed to a gradually decreasing thickness of corrosion product. J. W. S.

Oxidation of gold. P. A. Thiessen and H. Schütza (Z. anorg. Chem., 1939, **243**, 32—38).—When Au is highly dispersed by sparking in an ozonised atm. the product contains ~40% of an amorphous Au oxide. At 150° it evolves O_3. Very finely divided Au, obtained by reduction of Au_2O_3 in H_2 at 350°, is appreciably oxidised by O_2 at 450°. F. J. G.

Calcium hypochlorites of high titre and their preservation.—See B., 1940, 128.

Exchange between a metal and ions in solution using radioactive indicators. B. V. Rollin (J. Amer. Chem. Soc., 1940, **62**, 86—87).—Zn powder when shaken with aq. $ZnCl_2$ containing Ra-Zn for 1 hr. became appreciably radioactive. By bombarding Pd with ^2_1D, Ra-^{106}Ag was obtained and converted into Ra-$AgNO_3$ (I). On shaking polished sheets of Ag, Au, or Pt in this solution for 24 hr. radioactive exchange took place. Ra-Ag was obtained by electrolysis of (I) and on shaking it, in the form of a mirror, with inactive $AgNO_3$ solution for 2 hr. an exchange corresponding with 10 at. layers was effected. Pre-treatment of the Ra-Ag mirror with $NaNO_3$ greatly increases the exchange. No acceptable mechanism can be advanced. W. R. A.

Decomposition of mercuric ferrocyanide. A. A. Bombelli (Anal. Asoc. Quím. Argentina, 1939, **27**, 172—177).—$Hg_2[Fe(CN)_6]$ is decomposed by H_2O and the $Fe(CN)_2$ produced then polymerises to $Fe_2[Fe(CN)_6]$. F. R. G.

Dissociation in alcohols of compounds of the type HgPhR, where R is an acid residue.—See A., 1940, II, 59.

Reaction of boron fluoride with boron trioxide, borates, carbonates, and nitrates. Possible boron oxyfluoride $(BOF)_3$. P. Baumgarten and

W. BRUNS (Ber., 1939, **72**, [*B*], 1753—1762).—BF_3 and B_2O_3 do not interact at room temp. At 100° B_2O_3 is noticeably volatilised and at higher temp. the phenomenon becomes more marked so that complete volatilisation is readily achieved. The resulting volatile compound is stable only at high temp. and deposits a colourless *compound* (I) on cold parts of the apparatus. The composition of (I) is variable but it must be regarded as a true compound since it does not evolve BF_3 in a vac. at room temp. and, further, since B_2O_3 does not adsorb BF_3 at room temp. (I) is amorphous but on exposure to moist air gives cryst. HBO_2. Union of B_2O_3 with BF_3 occurs without change of gas vol.; the simplest possible reaction is $B_2O_3 + BF_3 = B_3O_3F_3$ and the formula $O{<}^{BF\cdot O}_{BF\cdot O}{>}BF$ is suggested. KBO_2 and BF_3 do not afford additive products but react quantitatively: $3KBO_2 + 6BF_3 = 3KBF_4 + 2(BOF)_3$; K_2OBF_3 is possibly formed intermediately. With KNO_3 and K_2CO_3 the changes are: $6KNO_3 + 9BF_3 = 6KBF_4 + (BOF)_3 + 3N_2O_5\ (2NO_2 + O)$ and $3K_2CO_3 + 9BF_3 = 6KBF_4 + (BOF)_3 + 3CO_2$. Reaction is similar with salts of the alkaline earths except that metallic fluorides are the final products. Li_2CO_3 is intermediate, giving a mixture of $LiBF_4$ and LiF, which is transformed completely into LiF when strongly heated. MgO and BF_3 react thus: $3MgO + 3BF_3 = 3MgF_2 + (BOF)_3$; a similar reaction proceeds less readily with CaO. BF_3 can displace the weak SiO_2 from silicates and the displaced oxide is volatilised as SiF_4. At higher temp. BF_3 and glass give borofluorides or fluorides. H. W.

Additive products of boron fluoride to sulphates and phosphates. P. BAUMGARTEN and H. HENNIG (Ber., 1939, **72**, [*B*], 1743—1753).—In the mols. of SO_3 and BF_3 the central atom is surrounded by an electron sextet; the compounds therefore tend to add to the lone electron pair of an atom of another compound with formation of the stable electron octet. K_2SO_4 and BF_3 at ~300° give K_2SO_4,BF_3, m.p. 240° after softening at 160°, incipient decomp. 260°, which when heated dry evolves BF_3 but gives the liquid, $[(OH)_2F_2B]H$, if there has been any previous exposure to moisture. At 270—280° there is further absorption of BF_3, which ceases before 2 mols. have reacted. The more reactive Cs_2SO_4 yields the *substance*, $Cs_2SO_4,2BF_3$, at 250—300°. The *compound*, Na_2SO_4,BF_3, is formed only at 310—330° when the material is spread in a very thin layer. Li_2SO_4, which does not appear to afford $Li_2S_2O_7$, absorbs very little BF_3. The alkaline-earth sulphates are indifferent towards BF_3. The *compound*, Tl_2SO_4,BF_3, is described but no addition is observed with Ag_2SO_4. The sulphate–borofluorides are true additive compounds. When heated they evolve BF_3. They are almost immediately decomposed by H_2O into sulphate and BF_3, which is hydrolysed to H_3BO_3 and HBF_4. At ~400° $K_4P_2O_7$ and $Na_4P_2O_7$ give the corresponding *tetraborofluorides* whilst under certain conditions $Na_4P_2O_7$ can add $5BF_3$ whereby some further change appears to be involved. K_3PO_4 and Na_3PO_4 at ~400° yield *triborofluorides*; if reaction is very prolonged Na_3PO_4 can add $4BF_3$. In these reactions SO_3 differs from BF_3. In cold H_2O after cautious neutralisation with NaOH the orthophosphate products give no reaction or only a slight ppt. with $AgNO_3$. Ag_3PO_4 is pptd. slowly if the solution is kept, rapidly if it is boiled, and the amount is increased by subsequent addition of NaOH. Solutions of the P_2O_7'''' complexes similarly give a ppt. of Ag_3PO_4, not $Ag_4P_2O_7$. The added BF_3 appears to cause a loosening of the linkings in the pyrophosphate and a readier hydrolysis of P_2O_7'''' to PO_4'''. H. W.

Active oxides. CXVI. Transformation of γ-aluminium oxide into α-aluminium oxide and the influence of foreign gases on it. G. F. HÜTTIG and G. MARKUS (Kolloid-Z., 1939, **88**, 274—288; cf. A., 1939, I, 328).—The conversion of γ- into α-Al_2O_3 by heating in air, studied by *X*-ray analysis, occurs at temp. >850°, in agreement with data previously published. When γ-Al_2O_3 is heated in dry HCl the conversion occurs much more readily and at a lower temp. The influence of a no. of gases was found to decrease in the order HCl > SO_3 + air > HBr, H_2O > Cl_2 > NO_2 + air > SO_3 > N_2 > air > CO_2 > NO_2. The solubility of Al_2O_3 in aq. HCl and in fused $K_2S_2O_7$ depends on its thermal history and on whether it has been heated in HCl or not. Above 950° all specimens become less sol., but at lower temp. some behave irregularly. Specimens heated in HCl at 670° are completely anhyd. and show as low a solubility as those heated in air at 950°. F. L. U.

Interchange of bases in crystals of β-alumina. N. A. TOROPOV and M. M. STUKALOVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 459—461).—Base exchange was observed on fusing Ba β-Al_2O_3 with Na_2CO_3, K_2CO_3, or Rb_2O, and extracting the product with 1 : 1 HCl. The products contained Na_2O 6·52—6·70, BaO 0·30—0·70; K_2O 10·16, BaO 4·18; Rb_2O 6·33, BaO 11·63%, respectively. The alkali content was in each case > that found by other observers. Optical and physical data are given. H. J. E.

Anhydrous aluminium perchlorate. E. G. HACKENBERG and H. ULICH (Z. anorg. Chem., 1939, **243**, 99—109).—Attempts to prepare anhyd. $Al(ClO_4)_3$ by the action of amalgamated Al on anhyd. $HClO_4$, alone or in org. solvents, from $Al(OMe)_3$ and $HClO_4$ vapour, and from Al_2O_3 and NH_4ClO_4, all failed, but by the action of anhyd. $HClO_4$ on pure $AlCl_3$, followed by evaporation of unchanged $HClO_4$ and sublimation of unchanged $AlCl_3$, an anhyd. product containing ~75% of $Al(ClO_4)_3$ and 5—15% of $AlCl_3$ was obtained. Vals. of Λ for solutions of this product, of $AlCl_3$, and hence, by extrapolation, of $Al(ClO_4)_3$ in $PhNO_2$, MeCN, and $OH\cdot[CH_2]_2\cdot OEt$ are given. Al cannot be deposited by electrolysis of these solutions. F. J. G.

Spectrometry of complex salts of 8-hydroxyquinoline-5-sulphonic acid. J. MOLLAND (Tids. Kjemi, 1939, **19**, 160—161).—Ultra-violet absorption spectra show that Al, Cu, Pb, Co, and Ni, but not Na, K, Ca, Sr, Ba, Mg, Tl, Cr, and Mn, form complex anions with 8-hydroxyquinoline-5-sulphonic acid in aq. solution. M. H. M. A.

Aluminium silicofluoride : preparation in the solid state and properties. A. A. SANFOURCHE and A. KRAPIVINE (Bull. Soc. chim., 1939, [v], **6**, 1689—1696).—Aq. H_2SiF_6 treated with $PbCO_3$ yields $PbSiF_6$, which is filtered free from excess of $PbCO_3$ and treated immediately with aq. $Al_2(SO_4)_3$. The $PbSO_4$ is separated, and the aq. $Al_2(SiF_6)_3$ is conc. by evaporation at room temp. under reduced pressure, when crystals of the *hydrate* $Al_2(SiF_6)_3,9H_2O$ separate. These must be removed from the solution before the latter becomes cloudy through separation of SiO_2. The crystals are washed with EtOH and Et_2O and dried at room temp. over H_2SO_4. Other methods of prep. by double decomp. are less successful. The compound has an acid reaction and its solutions are decomposed by H_2O the more rapidly the higher is the temp. At 90° gelatinous SiO_2 is formed. Alkalis also cause immediate decomp. The various possible modes of hydrolysis are discussed. The solid hydrate is not decomposed by conc. acids. When heated it loses H_2O and at ~500° it yields the *hydrate* $Al_2(SO_4)_3,6H_2O$. At higher temp. it is decomposed into SiF_4 and AlF_3. Methods of analysis of the compound are discussed in detail.

J. W. S.

Extraction of cerium from monazite earths. I. A. ATANASIU and M. BABOR (Bull. Acad. Sci. Roumaine, 1939, **20**, 27—31).—Neckers and Kremers' electrolytic method for the separation of Ce from monazite (A., 1928, 603) is unsuitable for use with H_2SO_4 solutions, as the pptd. Ce^{IV} phosphate (I) is gelatinous and contains Th. The process is preferably carried out at room temp. with a solution containing 5·8—29·3% of $Ce_2(SO_4)_3$ and 12—25% of H_2SO_4, prepared directly from the monazite; the higher concns. are advantageous. A large anode (c.d. 1 amp. per sq. dm. of gauze, at 3·8—4 v.) and a small cathode of Pt or peroxidised Pb are used with no diaphragm. The (I) is pptd. by dilution to 10% of H_2SO_4 and addition of NaH_2PO_4. After repeated washing with hot H_2O or 2% H_2SO_4, the (I) is ~98% pure; further purification is effected by repptn. by a similar method. A. J. E. W.

Ceric phosphate. I. A. ATANASIU and M. BABOR (Bull. Acad. Sci. Roumaine, 1939, **20**, 32—34).—A gelatinous ppt. of $Ce_3(PO_4)_4,nH_2O$ is obtained on addition of H_3PO_4 or an alkali phosphate to aq. $Ce(SO_4)_2$ or $Ce(NO_3)_4$ containing 5% of acid, or by electrolytic oxidation of Ce^{III} salts in presence of H_3PO_4 (cf. preceding abstract); $n = 11$, 5, or 0 after drying at 110°, 200°, or 500°, respectively. The hydrates are sparingly sol. and the anhyd. salt is insol. in dil. acids, but addition of H_2O_2 causes immediate reduction to sol. $CePO_4$. A. J. E. W.

Action of liquid ammonia on sulphur trioxide addition compounds. H. H. SISLER and L. F. AUDRIETH (J. Amer. Chem. Soc., 1939, **61**, 3392—3393).—Principally $NH_2{\cdot}SO_3NH_4$ is formed by the action of liquid NH_3 on SO_3 additive compounds with C_5H_5N, $NPhMe_2$, dioxan, HCl, and NaCl. The process is ammonolytic. In addition NH_4 imidodisulphonate is formed and its amount increases as the stability of the SO_3 compound diminishes. W. R. A.

Oxidation of hydrazoic acid with concentrated nitric acid. G. CARONNA and B. SANSONE (Gazzetta, 1939, **69**, 739—744).—The action of HN_3 on conc. HNO_3 consists of: $HN_3 + HNO_3 = N_2 + 2NO + H_2O$, together with the two secondary processes: $2NO + HNO_3 + H_2O = 3HNO_2$ and $NO + 2HNO_3 = 3NO_2 + H_2O$. With fuming HNO_3 only N_2 and N_2O are evolved, as in the reaction between HN_3 and HNO_2. O. J. W.

Preparation and determination of some inorganic salts : hydrazinium chloride and nitrate and potassium selenate, azide, and *iso*cyanate. A. CHRÉTIEN and O. HOFFER (Bull. Soc. chim., 1939, [v], **6**, 1587—1599).—20% aq. NH_3 (1 l.) is mixed with 2% aq. gum arabic (50 c.c.) and then 40% aq. NaOCl (500 c.c.) is added. The solution is evaporated to half vol., cooled to 0°, and 60 c.c. of H_2SO_4 are added. After three crystallisations from H_2O ~40 g. of N_2H_4,H_2SO_4 are obtained. This is converted into N_2H_4,HCl or N_2H_4,HNO_3 by treatment first with $BaCO_3$ and then with $BaCl_2$ or $Ba(NO_3)_2$. The solution is conc. at 60° under reduced pressure and then cooled to −10°, when the salt crystallises. N_2H_4 in these salts can be titrated iodometrically by Stollé's method, if the aq. $NaHCO_3$ used is saturated with CO_2. N_2H_4,HNO_3 and NH_4NO_3 can also be determined by measuring the vol. of N_2 produced when they are oxidised by NaOBr at room temp. A special form of nitrometer for this purpose is described. For the prep. of K_2SeO_4, Se, purified by dissolution in conc. H_2SO_4, dilution with H_2O, and repptn. with SO_2, is oxidised to SeO_2 by treatment with HNO_3 and its solution is evaporated to dryness on the H_2O-bath. This is then treated with sufficient K_2CO_3 to convert it into K_2SeO_3, which is crystallised and converted into K_2SeO_4 by heating in a stream of air at 900°. K_2SeO_4 can be determined iodometrically by treatment with HCl and then with KI, or gravimetrically by reduction with HCl and then with SO_2 to Se which is weighed directly. In the prep. of KN_3, HN_3 generated from NaN_3 and dil. H_2SO_4 is condensed and led into aq. KOH at 20° until this is neutral to phenolphthalein. The solution is evaporated at 50° under reduced pressure and the product is recrystallised from H_2O and dried at 50—120°. KN_3 can be determined by pptn. of N_3' by addition of excess of 0·1N-$AgNO_3$, the excess of which is determined. In the prep. of KCNO, $K_4Fe(CN)_6$ and $K_2Cr_2O_7$, both powdered finely and dried, are introduced in small quantities into an Fe crucible heated at ~400°. After cooling to 60° the product is treated with a solution containing EtOH (70 g.), MeOH (15 g.), and H_2O (15 g.). The solution produced is separated and cooled to −10°. The crystals of KCNO are washed with EtOH and Et_2O and finally with pure Et_2O. It can be freed from K_2CO_3 by recrystallisation from aq. EtOH. KCNO can be determined by treatment with excess of 0·1N-$AgNO_3$ and titration of the excess of Ag.

J. W. S.

Constitution of heteropoly-acids. II. Complex phosphododecatungstates. G. SPACU and V. NICOLAESCU (Bull. Acad. Sci. Roumaine, 1939, **22**, 130—141; cf. A., 1939, I, 212).—By interaction of

phosphododecatungstic acid $[P(W_2O_7)_6]H_7,16H_2O$ with suitable ammines the following *complexes* have been obtained; $H_4[P(W_2O_7)_6][Co\ en_2(NO_2)_2]_3,8H_2O$; $H_4[P(W_2O_7)_6][Co(NH_3)_4(NO_2)_3]_3,7H_2O$; $H_3[P(W_2O_7)_6][Cr(NH_3)_5Cl]_2,17H_2O$; $H_3[P(W_2O_7)_6][Co(NH_3)_5NO_3]_2,11H_2O$; *trans*-$H[P(W_2O_7)_6][Co\ en_2Cl_2]_6,15H_2O$; $H[P(W_2O_7)_6][Cr(NH_3)_5SCN]_3,14H_2O$; $H[P(W_2O_7)_6][Co\ en_3]_2,16H_2O$; $H[P(W_2O_7)_6][Cr\ en_3]_2,19H_2O$; $[Cr\ en_3]_2[P(W_2O_7)_6][NH:C(NH_2)_2],19H_2O$. J. W. S.

Phosphonitrile fluorides. II. O. SCHMITZ-DUMONT and A. BRASCHOS (Z. anorg. Chem., 1939, **243**, 113—126; cf. A., 1938, I, 468).—*Tetraphosphonitrile tetrachlorotetrafluoride*, $P_4N_4Cl_4F_4$ (I), has been isolated from the products of reaction between $P_3N_3Cl_6$ and PbF_2 at 300°. It has m.p. −25·2° to −24·9°, and its v.p. is given by log $p = 7{\cdot}615 - 1911/T$, from which the b.p. is 130·5°, the mol. heat of vaporisation 8742 g.-cal., and the Trouton const. 21·66. It has ρ^0 1·9568, ρ^{22} 1·9266, ρ^{30} 1·9162. Its degree of dissociation at 200—300° is < for $P_4N_4Cl_2F_6$ (*loc. cit.*) but ≫ for $P_4N_4Cl_8$, so that progressive substitution of F for Cl diminishes the stability of the higher polymerides. When heated under pressure at 300°, (I) is transformed into a rubber-like *substance*, and the cracking of this at 250—400° yields a mixture of volatile products from which *triphosphonitrile dichlorotetrafluoride*, $P_3N_3Cl_2F_4$, b.p. 115—117°, and *tetrachlorodifluoride*, $P_3N_3Cl_4F_2$, b.p. 140—142°, have been isolated. F. J. G.

New class of ammines. Complex thioarsenates. G. SPACU and A. POP (Bull. Acad. Sci. Roumaine, 1937—8, **19**, 117—131; cf. A., 1939, I, 332, 333).—The following *compounds* have been prepared from $Na_3(AsS_4),8H_2O$: $[Cr\ en_3]AsS_4,2H_2O$; $[Cr_4(OH)_6\ en_6][AsS_4]_2,6H_2O$; $[Cr(NH_3)_5CNS]_3[AsS_4]_2,3H_2O$; $[Cr(NH_3)_5Cl]_3[AsS_4]_2,3H_2O$; $[Cr_4(OH)_6(NH_3)_{12}][AsS_4]_2,6H_2O$; $[Cr(NH_3)_5NO_2]_3[AsS_4]_2,3H_2O$; $[Co\ en_3]AsS_4,2H_2O$; $[Ni\ en_3]_2AsS_4Cl,5H_2O$; $\{Cr[CO(NH_2)_2]_6\}AsS_4,1—2H_2O$; $[Co(NH_3)_6]AsS_4,0—1H_2O$; $[Ni\ en_3]_2AsS_4Cl$; $[Ni\ en_3]_2AsS_4NO_3$. The prep. of the last four compounds suggests the existence of the $[AsS_4]'''$ ion rather than $[AsS_4(H_2O)_2]'''$ proposed by Brintzinger and Osswald. D. F. R.

Complex vanadates. P. G. SPACU (Bull. Acad. Sci. Roumaine, 1939, **22**, 42—48).—The following complex *compounds* are pptd. on addition of NH_4VO_3 to aq. MCl_2, MSO_4, or $M(NO_3)_2$ containing C_5H_5N: $[M(C_5H_5N)_4](VO_3)_2$ (M=Cu, Co, Ni), $[M(C_5H_5N)_2](VO_3)_2$ (M = Hg, Zn, Mn, Cd). A. J. E. W.

Preparation of sulphamic acid by the hydroxylamine–sulphur dioxide reaction. H. H. SISLER and L. F. AUDRIETH (J. Amer. Chem. Soc., 1939, **61**, 3389—3391).—The reaction between $(NH_2OH)_2,H_2SO_4$ (I) and SO_2 has been studied at a pressure of 3·5—4 atm. using different concns. of (I) and different reaction times. Reaction is slower with conc. solutions of (I) than with more dil. solutions because of the building up of a high concn. of $H_3O^{\cdot}$ ions thus: $NH_3OH^{\cdot} + SO_2 + 2H_2O \rightarrow NH_2{\cdot}SO_3' + 2H_2O$. The reaction between acetoxime and SO_2 is also promoted by pressure and gives better yields of $NH_2{\cdot}SO_3H$. A proposed mechanism for the reaction involves co-ordination between NH_2OH and SO_2 and subsequent rearrangement to $NH_2{\cdot}SO_3H$, and satisfactorily explains observed phenomena. W. R. A.

Mechanism of formation of polythionic acids. II. Building-up of polythionic acids by means of thiosulphurous acid. H. STAMM and M. GOEHRING (Z. anorg. Chem., 1939, **242**, 413—426).—A detailed account of work already noted (A., 1939, I, 382). F. J. G.

Existence of a selenium iodide. J. D. MCCULLOUGH (J. Amer. Chem. Soc., 1939, **61**, 3401—3402).—Evidence for the existence of Se_nI_2 (n undetermined) is adduced from examination of the absorption spectrum of Se + I in CS_2 and from quant. measurements of the equilibrium between Se and I in CCl_4. W. R. A.

Reactions of chromates at high temperatures. XI. Structures of chromium chromates. D. S. DATAR and S. K. K. JATKAR (J. Indian Inst. Sci., 1939, **22**, A, 287—307).—Intermediate stages in the decomp. of CrO_3 and of Ca, Sr, and Ba chromates are represented by structural formulæ as Cr^{III} chromates or double chromates. F. J. G.

New modification of manganese dioxide. O. GLEMSER (Ber., 1939, **72**, [*B*], 1879—1881).—MnO_2 is obtained from $MnSO_4 + NH_4SO_4$, $MnSO_4 + KMnO_4$, and from $BaMn_2O_8$ and a very slight excess of H_2SO_4 followed by removal of $BaSO_4$ and concn. of the filtrate at 45°. The cryst. nature of the products is improved by boiling with $2N$-H_2SO_4. The type of crystal remains uncertain and the third prep. contains pyrolusite. A new *allotrope*, γ-MnO_2, is present. H. W.

Metallic carbonyls. XXX. Rhenium–carbon monoxide compounds. H. SCHULTEN (Z. anorg. Chem., 1939, **243**, 164—173).—*Re halogeno-pentacarbonyls* $Re(CO)_5X$ (X = Cl, Br, I) are obtained when K_2ReX_6 or other Re halogen compounds are heated in CO at 230° and 200 atm. They are stable in air and insol. in H_2O but sol. in org. solvents, and can be sublimed in a CO atm. F. J. G.

Constitution of the alleged "Thiessen hydrates." H. B. WEISER, W. O. MILLIGAN, and W. J. COPPOC (J. Physical Chem., 1939, **43**, 1109—1120).—Although an improved technique has been used, attempts to prepare the alleged Thiessen hydrates of Fe_2O_3, SnO_2, and SiO_2 have failed (cf. A., 1935, 285, 433). C. R. H.

Orientation of phases formed during reduction of magnetite by hydrogen. M. BUJNOV, A. KOMAR, M. SHURAVLEVA, and G. TSCHUFAROV (Acta Physicochim. U.R.S.S., 1939, **11**, 571—584) —In the reduction of Fe_3O_4 by H_2 at 500° the Fe crystallites have their crystallographic axes parallel to those of the Fe_3O_4. In the first stage of reduction at 900°, FeO is formed with its axes parallel to those of the Fe_3O_4, and this orientation is unchanged on repeated oxidation and reduction. On further reduction the

Fe has its (001) plane and [110] direction parallel to the (001) plane and [100] direction of the FeO.

F. J. G.

Thermal decomposition of oxalates. II. Preparation of pure ferrous oxide. P. L. Günther and H. Rehaag (Z. anorg. Chem., 1939, **243**, 60—68).—Reactive mixtures of finely divided Fe and Fe oxides are best analysed by dissolving out the Fe with $Pb(NO_3)_2$. The use of $HgCl_2$ or $CuSO_4$ is inadvisable as they are too acid and dissolve some FeO. In the decomp. of FeC_2O_4 the following side reactions, leading to an impure product, usually occur: (1) $4FeO = Fe_3O_4 + Fe$ (below 570°); (2) $FeO + CO = CO_2 + C$; (3) $2CO = CO_2 + C$. They may be excluded by carrying out the decomp. at 850°, the substance being warmed to and chilled from this temp. as quickly as possible, and the gases being very quickly pumped away. In this way FeO of 99·98% purity has been obtained. F. J. G.

Metallic carbonyls. XXIX. Mechanism of the high-pressure synthesis of cobalt carbonyl from cobalt halides. H. Schulten (Z. anorg. Chem., 1939, **243**, 145—163; cf. A., 1939, I, 212).—The prep. of $[Co(CO)_4]_2$ (I) from anhyd. Co halides and CO has been studied. There is no formation of C oxyhalide. The reaction occurs most easily with the iodide, less so with the chloride and bromide, and not at all with the fluoride. CoI_2 reacts with CO (at 100 atm.) even at room temp., affording an additive *compound*, CoI_2,CO, which is appreciably volatile, and the further reaction to (I) occurs through its vapour at the (Cu or Ag) walls of the autoclave. Admixture of finely-divided metals with the Co halide greatly increases the yield of (I), the effect increasing in the order Au < Pt < Ag < Cu < Cd or Zn. These metals, when heated with $CoBr_2$ in an inert atm., displace Co up to a certain equilibrium val., which is displaced when Co is removed by combination with CO. F. J. G.

Class of ammines containing 8-hydroxyquinoline and 5 : 7-dibromo-8-hydroxyquinoline. G. Spacu and C. G. Marcaovici (Bull. Acad. Sci. Roumaine, 1939, **22**, 150—161).—By interaction of the K salts of 8-hydroxyquinoline (X) and 5 : 7-dibromo-8-hydroxyquinoline (Y) with various ammines the following *complexes* have been prepared; $[Co(NH_3)_6]X_3,4H_2O$; $[Co(NH_3)_5SCN]X_2,5H_2O$; $[Co\ en(NH_3)_2]X_3,6H_2O$; $[Co\ en_3]X_3,6H_2O$; $[Cr(NH_3)_6]X_3,2H_2O$; $[Cr\{CO(NH_2)_2\}_6]X_3,4H_2O$; $[Co(NH_3)_6]Y_3$; $[Co\ en_3]Y_3$; $[Co\ en_2(NH_3)_2]Y_3$; $[Co\ en_2(SCN)_2]Y$; $[Cr\ en_3]Y_3$; $[Cr\{CO(NH_2)_2\}_6]Y_3$; $[Cr(antipyrine)_6]Y_3$; $[Cr(NH_3)_6]Y$. J. W. S.

Hydrates of cobalt, nickel, and copper sulphates. A. Simon and H. Knauer (Z. anorg. Chem., 1939, **242**, 375—392).—The higher hydrates of $CoSO_4$ and $NiSO_4$ have been studied by means of X-rays, tensimeter curves, and extraction with NH_3, and compared with $CuSO_4,5H_2O$. The isobaric dehydration of $NiSO_4,7H_2O$ (I) at 11 mm. affords at 65° the tetragonal $NiSO_4,6H_2O$ (II), and this at 67° affords $NiSO_4,4H_2O$ (III). The monoclinic $NiSO_4,6H_2O$ (IV) at 67° at first has an abnormally low v.p., and then may react in one of two ways, either breaking down suddenly to (III) or becoming transformed into (II), which then dissociates normally. When ground in air at room temp. (I) rapidly loses H_2O, affording (IV), which may be conveniently prepared in this way. In the isobaric dehydration of $CoSO_4,7H_2O$ (V) evidence for the existence of *$CoSO_4,6·5H_2O$* (VI), and of a range of mixed crystals between this and $CoSO_4,6H_2O$ (VII), is obtained. On extraction with liquid NH_3, (II) and (IV) afford the same products (hexamminomonohydrates) as (I) and (V). This suggests that if the heptahydrates have a hexaquo-cation and one H_2O mol. bound to the SO_4 group, the latter persists in the hexahydrates, which would then have a pentaquo-cation, and as this is very unlikely the heptahydrates probably have a structure analogous to that of $CuSO_4,5H_2O$. From the tensimeter curves the following heats of formation are calc.: (V) from (VI), 4·6; (VI) from (VII), 4·7; (I) from (II), 10·5; and (II) from (III), 21·8 kg.-cal. per g.-mol.

F. J. G.

Stereochemistry of complex inorganic compounds. VI. Stereoisomerides of the dichlorodiamminoethylenediaminecobaltic ion. J. C. Bailar, jun., and D. F. Peppard (J. Amer. Chem. Soc., 1940, **62**, 105—109).—The dichlorodiamminoethylenediaminocobaltic ion can exist in one *trans*- and two *cis*-forms, viz., *trans*-dichloro-*cis*-diammino- (I), *cis*-dichloro-*cis*-diammino- (II), and *cis*-dichloro-*trans*-diammino- (III). All three forms have been isolated and their properties are discussed. The asymmetrical ion (II) could not be resolved but its carbonato salt was resolvable. The compounds $NH_4[Co(NH_3)_4cis(SO_3)_2],3H_2O$ and $NH_4[Co\ en\ trans(NH_3)_2cis(SO_3)_2],2H_2O$ and the *compounds* $[Co\ en\ cis(NH_3)_2transCl_2]Cl,0·5H_2O$,

$[Co\ en\ trans(NH_3)_2cisCl_2]Cl,H_2O$,
$[Co\ en\ trans(NH_3)_2cisCl_2]Br,2H_2O$,
$[Co\ en\ trans(NH_3)_2cisCl_2]I$,
$[Co\ en\ trans(NH_3)_2cisCl_2]SCN,NaSCN$,
$[Co\ en\ cis(NH_3)_2cisCl_2]Cl(Br)$,
$[Co\ en\ cis(NH_3)_2transBr_2]Br(SCN)$,
$[Co\ en\ cis(NH_3)_2CO_3]_2CO_3$,

and $[Co\ en\ trans(NH_3)_2CO_3]_2CO_3,3H_2O$ are described.

W. L. A.

Conversion into chlorides of some metals of the platinum family by ammonium chloride vapours in the presence of oxygen. M. Delépine (Bull. Soc. chim., 1939, [v], **6**, 1471—1479).—Rh, Pd, Ir, and Pt, mixed with CsCl, are attacked by NH_4Cl vapours in presence of O_2 at a red heat and converted into chlorides. The reaction is attributed to interaction between HCl in the vapour and O_2, yielding Cl_2 which attacks the metal. The chlorides formed react with CsCl to form complex salts. Other alkali chlorides are less active than CsCl owing to their higher m.p. Ru and Os do not yield chlorides under similar conditions. J. W. S.

Nitrosyl compounds of platinum. A. Gelman and Z. P. Maximova (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 748—751; cf. A., 1938, I, 413).—Pt nitrosyl compounds have been formed by keeping a saturated solution of M_2PtCl_4 ($M = K$ or NH_4) in an atm. of NO. $M[PtCl_3NO]$ (I) is formed in solution and gives $[Pt(NH_3)_4][PtCl_3NO]_2$ when treated with

$[Pt(NH_3)_4]Cl_2$. I reacts with C_5H_5N to give $[PtCl_2NOC_5H_5N]$, which has a *trans* configuration; the *cis* form is unobtainable. T. H. G.

Flame method of spectrochemical analysis. W. A. ROACH (Nature, 1939, **144**, 1047).—The reproducibility and sensitivity of Ramage's method (A., 1929, 527) are increased by carbonising the filter-paper roll containing the sample in NH_4Cl vapour. This removes inflammable gases and converts the minerals into chlorides before the roll is burnt in the O_2–coal gas flame. L. S. T.

Essential corrections in gas analysis. J. J. LEENDERTSE and F. E. C. SCHEFFER (Rec. trav. chim., 1940, **59**, 3—13; cf. A., 1932, 241).—Corrections for departures from Dalton's (partial pressure) and Avogadro's laws are calc. for a no. of binary mixtures of gases measured at const. vol. The Avogadro correction is much more important at const. pressure than at const. vol. F. L. U.

Determination of the moisture content of gases.—See B., 1940, 104.

Detection of chloride ions in the presence of other halide ions. A. I. VELCULESCU and (MISS) J. CORNEA (Bull. Acad. Sci. Roumaine, 1937—8, **19**, 47—48).—The mixed halides are pptd. with $AgNO_3$ and the ppt. is treated with a solution of 4% CH_2O in 0·1N-NaOH, which reduces only the AgCl. The Cl may then be detected in the filtrate or by the presence of reduced Ag in the ppt. D. F. R.

Identification of halogens.—See A., 1940, II, 60.

Determination of hydrogen sulphide and cyanide in town's gas.—See B., 1940, 104.

Photocolorimetric determination of hydrogen sulphide in air as copper sulphide.—See B., 1940, 175.

Colour reactions of sulphur chlorides S_2Cl_2 and SCl_2 with *o*-tolidine and their analytical application. G. HOLST (Ber., 1939, **72**, [*B*], 1909—1913).—S_2Cl_2 in CCl_4 and *o*-tolidine in EtOH–CCl_4 (1 : 1) give an immediate, intensely red colour which is stable for several hr. in the dark at 0° but in bright daylight becomes green in a few min. and subsequently yellow. SCl_2 under similar conditions gives a much less intense red colour which even more rapidly becomes yellow. Extinctions for mixtures of SCl_2 and S_2Cl_2 are recorded, the greatest change being in the green region. In addition to the equilibrium, $2SCl_2 \rightleftharpoons S_2Cl_2 + Cl_2$, the change $S_2Cl_2 + 2S \rightleftharpoons (S_2Cl)_2$ appears important when the Cl content of the S chloride is low. H. W.

Submicro-determination of total nitrogen, ammonia, nitrates, etc.—See A., 1940, III, 176.

Determination of phosphorus in vanadium slags.—See B., 1940, 141.

Cerimetric determination of arsenic trihydride. G. MANNELLI (Annali Chim. Appl., 1939, **29**, 533—536).—The gas is passed through 0·1N-$Ce(SO_4)_2$, excess of which (*i.e.*, above that equiv. to the oxidation of the AsH_3 to H_3AsO_4) is titrated with 0·1N-$Fe(NH_4)_2(SO_4)_2$; 1 c.c. of 0·1N-$Ce(SO_4)_2$ = 0·9748 mg. of AsH_3. F. O. H.

Potentiometric titration of the arsenic ion with potassium iodide and sodium thiosulphate. G. SPACU and C. DRĂGULESCU (Bull. Acad. Sci. Roumaine, 1939, **22**, 1—15).—The solution (70—100 c.c.) containing ~0·075 g. of As^V and 30—40 vol.-% of conc. HCl is treated with 3—5 times the wt. of KI required by $H_3AsO_4 + 3I' + 2H^{\cdot} \rightleftharpoons H_3AsO_3 + I_3' + H_2O$, and after 5 min. the I liberated is titrated potentiometrically with 0·1M-$Na_2S_2O_3$ in an atm. of N_2. Any As^{III} present may be determined iodometrically in presence of $NaHCO_3$ before titration of the total As by the above method. The error is $\not>$0·3%. A. J. E. W.

Detection of phosgene and arsine.—See B., 1940, 175.

Analysis of mixtures containing primary potassium and primary ammonium phosphate. D. I. KUZNETZOV and A. A. KOSHUCHOVSKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 752—754).—Evaporation of 10 ml. of solution containing 0·1—0·3 g. of KH_2PO_4 or $NH_4H_2PO_4$ or a mixture of the two, followed by drying for 6 hr. at 100°, yields a practically anhyd. product of composition corresponding with these formulæ. The NH_4 in such a mixture can be found by driving off NH_3 and titrating, but the subsequent determination of the K is unsatisfactory. Good results can be obtained by adding 1—2 ml. of aqua regia for every 0·1 g. of $NH_4H_2PO_4$ and evaporating to dryness, when the NH_4 is eliminated as N_2 and NOCl. 2—3 ml. of $HClO_4$ are added when the odour of HCl and HNO_3 is no longer detectable, followed by H_2O to dissolve the pptd. $KClO_4$. After evaporation until $HClO_4$ vapour appears the solution is cooled and the $KClO_4$ pptd. by EtOH containing 0·2% of $HClO_4$ and filtered through sintered glass. The P_2O_5 is determined as $MgNH_4PO_4,6H_2O$, the lower hydrate first pptd. giving place to the hexahydrate when kept overnight. The accuracy is $\not<$ that attained by determination as $Mg_2P_2O_7$. T. H. G.

Detection of alkali and alkaline-earth metals. A. HEMMELER and F. N. STORTI (Annali Chim. Appl., 1939, **29**, 536—542).—The solution is pptd. with aq. NH_3–NH_4 phosphate–NH_4Cl and the ppt. is tested for Ba,. Sr, Ca, and Mg (methods of detecting Sr in presence of Ba are described). NH_3 and $NH_4^{\cdot}$ are removed from the filtrate by the CH_2O method (A., 1936, 1220) and the liquid is tested for Li (as Na Li phosphate), K (as K_2 Na cobaltinitrite), and Na (as $Na_2H_2Sb_2O_7,6H_2O$). F. O. H.

Detection of barium and sulphate by spot reactions. F. FEIGL and W. AUFRICHT (Rec. trav. chim., 1939, **58**, 1127—1132).—When $BaSO_4$ is pptd. in presence of $KMnO_4$ the ppt. is coloured pink, and the colour persists on addition of reducing agents. This is the basis of a spot test, for which working details are given, and by which 2·5 µg. Ba at a concn. of 1 : 20,000 can be detected. F. J. G.

Determination of radium in preparations freely emitting radon by measuring this in the nascent condition. A. JANITZKY (Kolloid-Z., 1939, **89**, 316—319).—The method consists in measuring the ionisation produced by the α-radiation afforded by a const. stream of air passing through the prep.,

and thus gives the rate of free emission of Rn. Examples are given. F. L. U.

Photelometric study of the lead–dithizone system at 610 mμ. C. L. GUETTEL (Ind. Eng. Chem. [Anal.], 1939, **11**, 639—640).—Using a 610-mμ. filter, the relationship between [Pb] and dithizone–$CHCl_3$ concn. which gives max. sensitivity for a given Pb range has been determined. For 0—15 μg. of Pb, the photelometer gives a precision >1%. L. S. T.

Amperometric (polarometric) titrations. I. Amperometric titration of lead with dichromate or chromate. I. M. KOLTHOFF and Y. D. PAN (J. Amer. Chem. Soc., 1939, **61**, 3402—3409).—In "amperometric" titrations the current which passes between two suitable electrodes at a const. applied e.m.f. is measured. Depending on the conditions, one or both electrodes are placed in the titration medium, and the end-point in general is the point of intersection of two lines giving the change in current before and after the equivalence point. The amperometric titration method has been applied to the accurate determination of $Pb^{\cdot\cdot}$ [in aq. $Pb(NO_3)_2$] with $K_2Cr_2O_7$ or K_2CrO_4, using the dropping Hg electrode as an indicator electrode. The method is sensitive to 0·001M-$Pb^{\cdot\cdot}$. $Pb^{\cdot\cdot}$ can also be titrated amperometrically in presence of large amounts of $Ba^{\cdot\cdot}$ when the solution is slightly acid with $HClO_4$. The fractional pptn. of $Pb^{\cdot\cdot}$ and $Ba^{\cdot\cdot}$ with K_2CrO_4 in a neutral medium is not accurate, owing to co-pptn. of $BaCrO_4$ and $PbCrO_4$. W. R. A.

Polarographic analysis of white metal.—See B., 1940, 141.

Specific microchemical reaction for the cupric ion. P. G. SPACU (Bull. Acad. Sci. Roumaine, 1939, **22**, 162—164).—If a drop of Na_2SO_4 solution (in EtOH) is treated with 2 drops of β-$C_{10}H_7$·NH_2 solution (conc. in 96% EtOH), and then a drop of the solution under test is added, a brownish-red ppt. of $[Cu(\beta\text{-}C_{10}H_7\cdot NH_2)_2]SO_4$ is formed immediately in the presence of $Cu^{\cdot\cdot}$. If 2N-KCNS is used instead of Na_2SO_4 a brownish-red ppt. of $[Cu(\beta\text{-}C_{10}H_7\cdot NH_2)_2](SCN)_2$ is obtained. The min. amounts of Cu detectable by these tests are 2 and 0·18 μg. and the limiting concns. in which Cu is detectable are 1 in 25,000 and 1 in 80,000, respectively. Fe and Au are the only common metals which interfere with the tests. J. W. S.

Determination of copper with salicylaldoxime.—See B., 1940, 138.

Rapid volumetric titration of copper in bronze etc.—See B., 1940, 139.

Separation of copper from zinc and nickel with sodium thiosulphate in the analysis of German silver.—See B., 1940, 139.

Action and distribution of mercury. XXIX. Surface phenomena and micro-analytical determination of mercury. A. STOCK (Ber., 1939, **72**, [*B*], 1844—1857).—A compact $HgCl_2$ film forms on the surface of neutral $HgCl_2$ solutions from which $HgCl_2$ evaporates so quickly at room temp. that the surrounding air is quickly saturated. Evaporation of $HgCl_2$ does not occur from acid solutions even if warm. Addition of NaCl, proteins, or extracts of organs hinders the evaporation. Probably the comparatively rapid evaporation of metallic Hg through H_2O, C_6H_6, etc. depends on a similar surface action. In neutral, but not in strongly acid, $HgCl_2$ solutions of widely differing concn. a unimol. $HgCl_2$ film is deposited on Pt; it is stable towards H_2O but can be removed by warm HCl. Film formation does not occur on SiO_2 on glass. Animal organs (heart, kidney, etc.) behave in the same manner at Pt; a part of the retained Hg can be brought into solution by HCl. In contact with SiO_2 or glass Hg disappears almost completely from dil. solutions of $HgCl_2$ in a few months; from conc. solutions the removal is restricted. The change is obviously chemical and not a surface phenomenon. Much less Hg is removed if the vessels have been treated previously with $HgCl_2$ solution or the latter is more strongly acidic. Only part of the Hg can be removed from the glass by HCl or Cl_2. The combination with and loss of Hg by glass is a source of error in the micro-determination of Hg, the magnitude of which has been investigated. The glass surface must be kept smooth and not abraded with a glass rod etc. In the analyses of the air expired by amalgam workers Hg is pptd. with the H_2O condensed at 0°. Probably this air contains $HgCl_2$ vapour in addition to Hg vapour. A similar explanation is applied to the observation that rain always carries appreciable amounts of Hg in spite of the minute Hg content of the atm. The bearing of these observations on the micro-determination of Hg is discussed. H. W.

Electrometric titration of precipitation reactions in mixtures of water and organic solvents. I. A. ATANASIU and A. I. VELCULESCU (Bull. Acad. Sci. Roumaine, 1937—8, **19**, 37—46).—Many pptn. titrations which have no sharp potentiometric end-point in pure H_2O have been successfully performed in mixtures of H_2O with MeOH, EtOH, $COMe_2$, Et_2O, PhOH, or glycerol. In the determination of Ce or La with $K_4Fe(CN)_6$, Pb with K_2CrO_4, Ba with K_2CrO_4, and Ag with KIO_3, the most satisfactory titration media are, respectively, 30% $COMe_2$ at 65°, H_2O saturated with Et_2O at 20°, 30% EtOH at 65°, and 30% MeOH at 20°. D. F. R.

Spectrographic analysis of aluminium alloys.—See B., 1940, 142.

Determination of aluminium oxide in aluminium.—See B., 1940, 142.

[Determination of] manganese and chromium in steel. Modified persulphate–arsenite method.—See B., 1940, 138.

Determination of traces of iron in aluminium.—See B., 1940, 141.

Amperometric titrations. II. Titration of nickel with dimethylglyoxime using the dropping mercury electrode as indicator electrode. I. M. KOLTHOFF and A. LANGER (J. Amer. Chem. Soc., 1940, **62**, 211—218; see above).—Ni in aq. NH_3 and NH_4Cl can be accurately titrated amperometrically with alcoholic dimethylgyloxime, using the dropping Hg electrode as indicator. Variations in $[NH_3]$ and $[NH_4Cl]$ do not affect the results.

Metal ions which are electro-reduced at the applied e.m.f. interfere when present in sufficient quantity. Co yields a diffusion current at this e.m.f., and also forms a sol. complex with the dimethylglyoxime. Co may therefore have to be separated chemically before titration, and its removal as K cobaltinitrite is approved. W. R. A.

Determination of very small amounts of molybdenum, applicable to biological media. D. BERTRAND (Bull. Soc. chim., 1939, [v], 6, 1676—1689).—The sample is ashed, dissolved in dil. acid, and the Mo separated from most other metals by treatment with cupferron and extraction with $CHCl_3$. If no Fe is present, $Fe^{\cdot\cdot\cdot}$ is added to the acid solution of the materials extracted by $CHCl_3$, and Fe and Sn are removed by addition of NH_3, when the SnO is adsorbed on the $Fe(OH)_3$. The Mo and Cu are then pptd. by H_2S and the Mo is separated from most of the Cu by redissolution of the MoS_3 in Na_2S. The solution is treated with hot HCl until no further H_2S is evolved, and the MoS_3 pptd. is separated, washed, and ignited cautiously. The residue is dissolved in aqua regia, and the solution evaporated to dryness and the salts taken up in H_2O. Na_2S is added and the solution is heated at $\sim 70°$ while H_2S is passed through the solution. The remainder of the Cu, which is pptd., is filtered off, and the filtrate ($\not> 9$ c.c.) is treated with 0·2N-NH_4Cl (1 c.c.) and boiled for 10—20 sec. to give colloidal MoS_3. The suspension is cooled to room temp. and the colour of the solution is examined photometrically, using a blue filter. The method permits the determination of $\not< 0.002$ mg. of Mo in 100 g. of dry org. matter. The accuracy is 2—3% for $\not< 50$ µg. of Mo. J. W. S.

Potentiometric titration of the stannous ion with potassium iodate. G. SPACU and C. DRĂGULESCU (Bull. Acad. Sci. Roumaine, 1939, 20, 1—16).—A potentiometric modification of the method of Korenman (A., 1936, 1091) is described. The solution (35—50 c.c.) containing ~ 0.025 g. of Sn^{II}, and 0·19—2·5N. with respect to HCl, is titrated with 0·01M-KIO_3 in an atm. of N_2. The first end-point ($Sn^{II} \rightarrow Sn^{IV}$) may be checked by continuing the titration, as complete reaction of the KI formed in the first stage of the process is shown by a second step in the potential curve. Fe^{II}, Pb, Cu, and Zn do not interfere. The mean error is $\sim 0.5\%$. A. J. E. W.

Visual determination of vanadium in ores etc.—See B., 1940, 141.

Potentiometric titration of the antimonic ion by means of potassium iodide and sodium thiosulphate. G. SPACU and C. DRĂGULESCU (Bull. Acad. Sci. Roumaine, 1939, 21, 85—105).—The I liberated by the reaction $Sb^{\cdot\cdot\cdot\cdot\cdot} + 2I' \rightleftharpoons I_2 + Sb^{\cdot\cdot\cdot}$ is titrated with 0·1M-$Na_2S_2O_3$ at room temp., and the end-point determined potentiometrically (cf. Z. Instrumk., 1899, 19, 249). The data recorded for the effects of varying the [HCl] and the [KI] show that with solutions containing ~ 0.07 g. of $Sb^{\cdot\cdot\cdot\cdot\cdot}$ in a final vol. of 100 c.c. the [HCl] must be $\not< 1.2$N. and only the stoicheiometric quantity of KI should be present; for solutions containing 0·1 g. Sb in 30—50 c.c. initial vol., the initial [HCl] must be 4N. and a large quantity of KI, 3—5 times the stoicheiometric amount, must be present to prevent loss of I. L. S. T.

Inorganic chromatography. IV. Chromatography as aid in qualitative analysis. G. M. SCHWAB and A. N. GHOSH (Angew. Chem. 1939, 52, 666—668; cf. A., 1938, 1, 638).—Practical details and chromatograms are given for the identification of cations in the following mixtures obtained by ordinary methods of qual. analysis: $Sb^{\cdot\cdot\cdot}$–$As^{\cdot\cdot\cdot}$–$Bi^{\cdot\cdot\cdot}$, $Sb^{\cdot\cdot\cdot}$–$As^{\cdot\cdot\cdot}$–$Cd^{\cdot\cdot}$, $Sb^{\cdot\cdot\cdot}$–$As^{\cdot\cdot\cdot}$–$Pb^{\cdot\cdot}$–$Cu^{\cdot\cdot}$–$Cd^{\cdot\cdot}$, $Fe^{\cdot\cdot\cdot}$–$Cr^{\cdot\cdot\cdot}$–$UO_2^{\cdot\cdot}$–$Zn^{\cdot\cdot}$–$Co^{\cdot\cdot}$–$Ni^{\cdot\cdot}$–$Mn^{\cdot\cdot}$, $Pb^{\cdot\cdot}$–$Ag^{\cdot}$–$Tl^{\cdot}$. Hg and Sn were difficult to detect chromatographically. S. M.

Flame testing [for heavy metals]. F. H. CAMPBELL (Chem. Eng. Min. Rev., 1939, 32, 73).—Instead of using a Pt wire for the flame test a test-tube half filled with glycerol (I) may be used; this is dipped into HCl, then into the sample, and again into HCl, after which it is held in the flame until the (I) boils. Characteristic lilac to blue colours are given by Sb, As, Bi, and Sn, whilst Sb and As also give a black mirror on the tube. A. R. P.

Assaying rich telluride gold ores.—See B., 1940, 141.

Radiation correction in calorimetry. F. E. HOARE (Phil. Mag., 1940, [vii], 29, 52—65).—An error in Rowland's graphical method is pointed out. Regnault's and Dickenson's methods are preferable to that of Nernst and Eucken. L. J. J.

Optical pyrometer for general use. J. G. HAGEDOORN (Physica, 1939, 6, 1126—1128).—High transmission combined with a large field of view and considerable magnification can be obtained by having slit-shaped diaphragms at the focal distances from both the eyepiece and objective lenses. L. J. J.

Photocalorimeter. Quantum efficiency of photosynthesis in algæ. J. L. MAGEE, T. W. DEWITT, (MISS) E. C. SMITH, and F. DANIELS (J. Amer. Chem. Soc., 1939, 61, 3529—3533).—The photocalorimeter has been designed to measure heat changes accompanying photochemical reactions. It consists of a small thin-walled quartz cell mounted in a cylindrical Al container which is kept at const. temp. by a double thermostat. A thermopile placed behind the cell measures the amount of radiation transmitted, and a multi-junction thermocouple measures the temp. difference between cell and container. Using this calorimeter the thermal efficiency of photosynthesis by green algæ (*Chlorella vulgaris* or *C. pyrenoidosa*) has been measured. About 0·8 of the red light absorbed in living algæ is converted into heat, leading to a quantum yield of ~ 0.08 mol. of CO_2 consumed per $h\nu$ absorbed. W. R. A.

Projection comparator of spectra. R. INTONTI and G. MILAZZO (Chim. e l'Ind., 1939, 21, 662—663).—A projection comparator, fitted with a micrometer measuring device, is described. O. J. W.

Achromatic objective for ultra-violet microscopy. B. K. JOHNSON (Proc. Physical Soc., 1939, 51, 1034—1039).—The low-power objective described and tested employs LiF combined with fused quartz,

giving achromatism for a wide range of the visible and ultra-violet. The use of certain ultra-violet filters with a modern high-pressure Hg-vapour lamp is discussed. N. M. B.

Methods of obtaining absorption spectra. P. POGÂNGEANU and H. TINTEA (Bull. Acad. Sci. Roumaine, 1939, **20**, 46—47).—Extinction coeff. determinations are unnecessary for most chemical purposes, as measurement of the λλ of the absorption max. by the Hartley–Bally method is adequate. Data obtained by this method (2100—6000 A.) are recorded for pyrene, anthracene, and 9 : 10-dichloro- and -dibromo-anthracene. A. J. E. W.

Quantitative absorption spectrophotometry. Internal control method. J. S. OWENS (Ind. Eng. Chem. [Anal.], 1939, **11**, 643—646).—The internal control method described permits the determination of extinction coeffs. or of % absorption to be made rapidly with the same apparatus and general technique as is used for quant. emission spectochemical analysis. The basis of the method is the determination of the relative intensity of selected λλ, one within an absorption band of the material, and the other in a region in which there is no absorption, of the spectrum of the substance. The analysis of a partly polymerised styrene for monomeride content is given in illustration of the method. Other applications are the analysis of org. chemicals for constituents or impurities, the analysis of blood-serum for the different hæmoglobin compounds, and the following of the course of a reaction. L. S. T.

Use of interferometer for two-component mixtures. G. C. HARROLD and L. E. GORDON (J. Ind. Hyg., 1939, **21**, 491—497).—This method of analysing mixtures of vapours employs previous calibration of the interferometer for the vapours known to be present. The composition of the liquid phase must be known, and no unknown or contaminating gases or vapours must be present. The method is applicable in many cases where no refractivity data are available. E. M. K.

Fixed path acoustic interferometer for the study of matter. J. C. HUBBARD and I. F. ZARTMAN (Rev. Sci. Instr., 1939, **10**, 382—386).—The reflector is maintained at a fixed distance from the piezoelectric resonator and resonance is established in gases by varying the temp., pressure, or composition and in liquids or solids by varying the frequency. As the method eliminates moving parts and packed joints it is particularly adaptable for measurements in gases at all temp. up to 500° and over a pressure range of 100 atm. Acoustic absorption and reflexion coeffs. may also be measured. Results obtained with air and CO_2 are given. D. F. R.

Precision photometry of heterogeneous light. H. KÖNIG (Helv. Phys. Acta, 1939, **12**, 519—535).—Theoretical. Light consisting of a no. of components of known spectral intensity distribution can be compared by means of a simplified filter method. L. J. J.

Potentiometer circuit for portable optical pyrometer. R. C. MACHLER (Rev. Sci. Instr., 1939, **10**, 386—388).—A single battery supplies both the lamp filament and the shunted potentiometer. A mechanical coupling of the filament rheostat and potentiometer slide-wire contacts ensures that the potentiometer is always approx. balanced, thus securing rapid manipulation of the instrument and preventing undue drain on the standard cell. D. F. R.

p_H measurements with the new high-conductivity glass electrodes. K. SCHWABE and O. HERDEY, jun. (Zellstoff u. Papier, 1939, **19**, 530—533, 567—570).—Glass electrodes having a high conductivity (*a*) are investigated for comparison with the less conducting MacInnes glass (*b*), of the following composition: SiO_2 72, CaO 6, and Na_2O 22%. Type (*a*) are shown to be less satisfactory than (*b*) since their change in potential with changing [H$^{\cdot}$] of the test solution follows Nernst's equation less closely than that of type (*b*), because of p_H increases due to dissolution of the glass in both buffered and unbuffered solutions and because of periodic and inconsistent changes in potential. It is considered also that it is possible to reduce the thickness of type (*b*) to give a conductivity comparable with that of (*a*) without unduly weakening the walls of the electrode. D. A. C.

Direct rapid chemical analysis with the dropping mercury electrode. J. BOEKE and H. VAN SUCHTELEN (Z. Elektrochem., 1939, **45**, 753—756).—Various methods of investigating reduction reactions with the dropping Hg electrode are discussed. Cathode-ray oscillograph and a.c. bridge methods for the rapid determination of the mean val. of the potential step associated with each cathodic reaction are described. J. W. S.

Rapid method of determining electrical conductivity and its temperature coefficient. A. KUSSMANN and L. MOLLWO (Z. Metallk., 1939, **31**, 344—345).—An apparatus which utilises a.c. in conjunction with an amplifier and rectifier is described; it can be used for the determination of resistances as low as 10^{-4} Ω. with an accuracy of <0·5% and, in combination with a recording device, for the determination of temp.–resistance curves in the study of metal systems. A. R. P.

Precision conductivity bridge assembly. W. F. LUDER (J. Amer. Chem. Soc., 1940, **62**, 89—95).—Several different forms of the oscillator and its power supply, of the bridge network, and of the amplifier, incorporating recent developments in a.c. bridge methods and communication engineering, have been constructed and tested. W. R. A.

Use of thin layers in electrophoretic separation. J. ST. L. PHILPOT (Trans. Faraday Soc., 1940, **36**, 38—46).—A large-scale electrophoretic separator in which the substance to be separated flows in a thin layer between layers of electrolyte adjusted to suitable *d* is described. The theory of the method, its advantages, and its limitations are discussed. J. W. S.

Absolute method of measuring the dielectric constant and losses in liquids by means of decimetre waves. M. DIVILKOVSKI (Compt. rend.

Acad. Sci. U.R.S.S., 1939, **24**, 433—436).—The method is based on the heating of a liquid placed in a thermometer bulb in an alternating field. Measurements for MeOH, EtOH, PrOH and 0·035N. aq. KCl for λλ 1—10 cm. are recorded. For relative vals. a knowledge of the field strength is unnecessary, but for abs. measurements the apparatus is calibrated by means of Hg. H. J. E.

Measurement of dielectric loss and of high-frequency conductivity. VII. H. SCHWINDT. **VIII.** P. WULFF and H. SCHWINDT (Z. physikal. Chem., 1939, **B**, **44**, 344—350, 351—358; cf. A., 1938, I, 436).—VII. The Rohde substitution method for measurement of loss angles (cf. A., 1938, I, 345) is developed theoretically for use with liquids of high dielectric const. and dielectric loss (*L*). A cell of small empty capacity is advantageous, and certain auxiliary condensers are used. Allowance is made for the ohmic resistance of the cell leads and losses in the capacity standard.

VIII. A distillation apparatus, transfer pipette, and quartz capacity cell which permit the manipulation of liquids with complete exclusion of atm. H_2O are described. The equiv. conductivities of EtOH–C_6H_6 mixtures are calc. from redetermined *L* vals.; the results confirm previous conclusions (*loc. cit.*), but traces of H_2O have such a large effect that vals. for a perfectly anhyd. system cannot be approached. A. J. E. W.

Cloud chamber for lecture experiments. R. HILSCH (Physikal. Z., 1939, **40**, 594—595).—Details of the construction of a cloud chamber, by means of which tracks of α-particles can be projected before an audience, are given. A. J. M.

Coincidence counter for low-energy β-particles. D. ROAF (J. Sci. Instr., 1940, **17**, 19—20).—A double counter for use with a magnetic β-ray spectrometer comprises a Pyrex tube, 3 cm. in diameter, bent so that the paths of the β-particles pass through both parts of the apparatus. Each end is silvered for 3·5 cm., and each central W wire (0·2 mm. diameter) is tipped with a bead of glass and is partly covered by a thin glass sleeve. A window 0·05 mm. thick is blown at one end of the bent tube. The counter is baked for 3 hr. at 450° and filled with He at 60 cm. pressure and EtOH at 1 cm. pressure. The central wires are connected to the grids of the amplifier with 60,000 Ω. leaks to earth. The counter is very stable and each half can count at a rate of $>10^4$ particles per sec. J. W. S.

Recent American advances in apparatus and in the technique of experimental physics. C. J. OVERBECK (J. Sci. Instr., 1940, **36**, 1—17).—Developments of equipment and technique are reviewed and illustrated. J. W. S.

Vacuum leak testing. J. H. MANLEY, L. J. HAWORTH, and E. A. LEUBKE (Rev. Sci. Instr., 1939, **10**, 389).—Several org. liquids have been used for vac. leak testing with a W filament ion gauge. Et_2O is the most satisfactory; $COMe_2$ is almost as sensitive but temporarily reduces the emission of the filament. D. F. R.

Drying laboratory glassware. C. G. MILLER (J. Chem. Educ., 1939, **11**, 518).—A simple arrangement, more generally useful than that described by Allison (A., 1938, I, 585), is illustrated. L. S. T.

Determination of the velocity of sound in a gas. Application to analysis of mixtures of helium, oxygen, and nitrogen. W. B. DUBLIN, W. M. BOOTHBY, and M. M. D. WILLIAMS (Science, 1939, **90**, 399—400).—An apparatus for this determination is described. It is particularly suitable for mixtures of He, N_2, and O_2. The velocity of sound can be determined with an accuracy of $\sim\pm0·5\%$, and the % of He and N_2 with one of $\sim\pm1·0\%$. A chart showing the velocity of sound at 24° in mixtures of He, O_2, and N_2, saturated with water vapour, is reproduced. L. S. T.

Device for rapid rinsing of absorption towers used in gas analysis. N. F. CHILDERS, D. C. KIPLINGER, and H. W. BRODY (Science, 1939, **90**, 447—448).—The application of the device to the Heinicke–Hoffman photosynthesis apparatus (A., 1933, 327) is described and illustrated. L. S. T.

Thermal manometer. R. S. VINCENT and A. SIMONS (Proc. Physical Soc., 1939, **51**, 1003—1009).—The new apparatus described records low abs. pressures (0·1—100 mm. Hg). The b.p. of Hg, boiling under the pressure to be measured, is recorded by a thermojunction. N. M. B.

Directly air-driven transparent ultracentrifuges. J. W. MCBAIN and A. H. LEWIS (J. Physical Chem., 1939, **43**, 1197—1205).—The construction and use of the ultracentrifuges are described and the theory of ultracentrifugal analysis is discussed. C. R. H.

Small centrifuge tube filter. T. PERRINE and W. KUMP (Ind. Eng. Chem. [Anal.], 1939, **11**, 658).—The usual centrifuge tube is modified to hold an inserted Pyrex filter plate and filter-paper. The tube is H_2O-proof and can be used at low temp. L. S. T.

Rapid circulating dialyser. A. R. TAYLOR, A. K. PARPART, and R. BALLENTINE (Ind. Eng. Chem. [Anal.], 1939, **11**, 659).—The apparatus described is suitable for the removal of high concns. of salts from protein solutions. L. S. T.

Lead–sodium alloy as a drying agent. H. SOROOS (Ind. Eng. Chem. [Anal.], 1939, **11**, 657—658).—The prep. of a Pb–Na alloy, which dries Et_2O as completely as Na wire, but is safer and more convenient to handle, is described. L. S. T.

Mechanically-operated continuous liquid-extraction apparatus. G. W. PUCHER and H. B. VICKERY (Ind. Eng. Chem. [Anal.], 1939, **11**, 656—657).—A modification of the Widmark extraction apparatus, suitable for the quant. removal of org. acids, nicotine, etc. from tobacco leaves, is described. L. S. T.

Capillary flowmeter with variable orifices. J. H. BRUUN (Ind. Eng. Chem. [Anal.], 1939, **11**, 655).—The capillary tube is made to permit max. flow of gas, and decreasing rates of flow are obtained by inserting Cr–Ni or Chromel wires of suitable gauge in the entire length of the capillary. L. S. T.

Automatic effusiometer for the determination of specific gravity of gases. G. V. Feskov (Ind. Eng. Chem. [Anal.], 1939, **11**, 653—654).—The apparatus described is more accurate than the manual type, and eliminates personal errors arising from the use of a stop watch. It is suitable for the routine determination of the sp. gr. of gases other than those containing H_2S. L. S. T.

Separation tube. I. Principles of a new process for the separation of gas mixtures and of isotopes by thermo-diffusion. II. Separation of the chlorine isotopes. K. Clusius and G. Dickel (Z. physikal. Chem., 1939, **B**, **44**, 397—450, 451—473).—I. A detailed account of work previously noted (A., 1938, I, 539; 1939, I, 224). The theory, construction, and use of the separation tube are exhaustively discussed.

II (cf. A., 1939, I, 211, 442). 480 c.c. of 99·6% pure $H^{35}Cl$ and 635 c.c. of 99·4% $H^{37}Cl$ have been separated with a series of separation tubes 36 m. long. The energy required for the process is $3·7 \times 10^{10}$ g.-cal. per g.-mol. and the efficiency of the separation is 9×10^{-9}, in satisfactory accord with theory. A. J. E. W.

Theory of the separation method of Clusius. P. Debye (Ann. Physik., 1939, [v], **36**, 284—294).—A simplified theory which is capable of practical application is developed. L. G. G.

Robert Hooke, chemist. C. de Milt (J. Chem. Educ., 1939, **11**, 503—510). L. S. T.

R. E. Liesegang as photochemist. K. Schaum (Kolloid-Z., 1939, **89**, 124—128).—A historical survey. F. L. U.

Geochemistry.

Isotopic composition of water from some rivers and lakes of the U.S.S.R. R. V. Teis (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 779—782).—Lake-H_2O usually has ρ 2 μg. > river-H_2O. River-H_2O from the Transbaikal region is lighter than that from other regions. H_2O from lakes and rivers fed by melting ice and snow has a low ρ and cannot be used as a standard for the measurement of ρ. T. H. G.

Chemical studies in lake metabolism. K. Sugawara (Bull. Chem. Soc. Japan, 1939, **14**, 375—451).—The lakes investigated are Takasuka-numa, the Nisina group in Nagano Prefecture, and the five lakes at the foot of Mt. Huzi. Data relating to the variation in the intensity of physical, chemical, and biological factors affecting the muds, the chemical composition of the muds, and their deposition, the ρ of the lake waters, and the dissolved gases in the waters are recorded and discussed. Modifications of Winkler's method for the determination of CO_2, and of the method described by Treadwell for CO, are given. L. S. T.

Salt content of the Raselm lakes. V. Grimalschi and V. Hohor (Bull. Acad. Sci. Roumaine, 1939, **20**, 17—25).—Salinity vals. (max. 11·6 g. of NaCl per l.) at various points in the Raselm and Babadag series of lakes (Danube delta) are correlated with the flow of fresh H_2O and other geographical factors. A. J. E. W.

Western Pacific Ocean. V, VI. Vertical variation of minor constituents in the "Kurosio" region. 1 and 2. Y. Miyake (Bull. Chem. Soc. Japan, 1939, **14**, 461—466, 467—471; cf. A., 1939, I, 342).—V. Temp. and % of dissolved O_2 both increase considerably as the depth increases. p_H shows a slight but regular decline from 8·25 at the surface to 7·78 at 1000 m. ρ measured *in situ* increases but the Cl content declines to a min. and then increases slightly.

VI. The proportions of SiO_3'', PO_4''', BO_3''', and Cu all increase as the depth increases although the F' content remains almost const. T. H. G.

Alkaline spring water of low hardness in Bucharest.—See B., 1940, 176.

Indices of texture of sediments. M. Popovăţ (Bull. Acad. Sci. Roumaine, 1936—37, **18**, 154—159).—The mechanical composition of sediments (soils, clays, sands) is characterised by two "indices of texture," viz., the mean diameter and the degree of homogeneity, which gives a measure of the distribution of deviations from the mean size. O. J. W.

Radioactive determination of protoactinium in siliceous terrestrial and meteoritic material. W. C. Schumb, R. D. Evans, and (Miss) J. L. Hastings (J. Amer. Chem. Soc., 1939, **61**, 3451—3455).—The [Pa] of a granite and of a specimen of Pultusk meteorite has been determined by a co-pptn. of the Pa with $ZrPO_4$ followed by the purification of the ignited pyrophosphate using a modification of the von Grosse method for the isolation of Pa from other radioactive elements (A., 1933, 110). The [Pa] of the specimens was calc. from the α-activity of the Pa isolated. The [Ra] of the same samples was also determined. From the wt. ratios Pa/Ra of the two samples, it is concluded that the age of the U atoms in these samples is approx. the same. W. R. A.

Molecular dissociation in the magma as a factor in its characterisation. G. Bilibin (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 783—785).—Minerals may be divided into three classes according to whether their m.p. is > or < their dissociation temp. or they dissociate in the solid state and do not crystallise in the mass on melting. The separation of the mols. during dissociation may be reduced to two principal types in which either loss of SiO_2 leads to a chemical formula of the same or simpler type or the mols. dissociate to simpler ones. Mol. dissociation on fusion influences the characterisation of the magma since certain constituents of the easily dissociated mols. may be eliminated from the magma in the early stages of the crystallisation with consequent enrichment of the residual solid in the remaining constituents. Alternatively in the deep magmatic

beds where the temp. is very high dissociation of the mols. takes place. After cooling at the edges of the bed association of certain mols. may take place and the constitution of the magma may be disturbed. Factors governing these magmatic changes include the rate of cooling of the magmatic hearth, and the relative rates of diffusion of the various dissociated mols. T. H. G.

Contribution of differential pressures to magmatic differentiation. R. C. Emmons (Amer. J. Sci., 1940, **238**, 1—21).—The separation of liquid from crystals through pressure differentials created by fracturing of brittle wall rocks is regarded as a process of primary importance in separating granitic liquid from more basic crystals. It explains: (i) that the outstanding difference between pegmatites and aplites is textural, (ii) why the upper parts of most intrusive bodies are higher in mineralisers than the rest of the mass, (iii) the production, under the influence of quartzite, of syenite from granite, (iv) the association of calcic and sodic pegmatite in one rock, and (v) the zoning of felspars and dioritic rocks. L. S. T.

Unit cell and space-group of monazite, (La,Ce,Y)PO$_4$. W. Parrish (Amer. Min., 1939, **24**, 651—652).—Monazite from Llallagua, Bolivia, has a 6·76, b 7·00, c 6·42 A., β 76° 50′, ρ 5·173, $\rho_{\text{calc.}}$ 5·06, cell vol., 296, 4 mols. per unit cell, space-group $P2_1/n$ (C_{2h}^5), formula $4La_2O_3,4Ce_2O_3,Y_2O_3,9P_2O_5$. Th is absent. L. S. T.

Active oxides. CXVII. Transformation of anatase into rutile and influence of gaseous hydrogen chloride on it. G. F. Hüttig and K. Kosterhon (Kolloid-Z., 1939, **89**, 202—208; cf. A., 1940, I, 126).—Hydrated TiO_2 (pptd.) was preheated at various temp. (0) between 750° and 1000°. Curves showing the change of H_2O content, hygroscopicity, solubility in 17M-H_2SO_4, d, and mean sp. vol. of the powder with 0 are given. X-Ray examination of the products indicates that the change in properties is due in some cases to re-grouping of surface mols. (max. at 0 = 820°) and in others to the bulk transformation of the lattice which occurs at 850—920°. Substitution of HCl for air in the preheating treatment does not appreciably affect the anatase–rutile transformation, but it promotes the formation and increases the duration of the " activated " state. F. L. U.

Metamorphism and assimilation in the Cooma district of New South Wales. I. Amphibolites and their metasomatism. G. A. Joplin (J. Proc. Roy. Soc. New South Wales, 1939, **73**, 86—106).—The Cooma amphibolites consist almost entirely of hornblende, plagioclase, and quartz. The even-grained type is in some cases cut by hornblende–quartz–plagioclase veins produced by reaction of solutions from adjacent gneiss and pegmatite intruded later than the original basic rock, probably a gabbro or norite. L. J. J.

Occurrence of greenockite in the Mendips. A. W. G. Kingsbury and J. N. Friend (Nature, 1939, **144**, 1013).—Calamine from Green Ore, Chewton Mendip, contains Zn blende (I), galena, and barytes. The (I) shows thin layers of greenockite. L. S. T.

New British locality for fluorite in Somerset. A. W. G. Kingsbury (Nature, 1939, **144**, 1013).—Small, colourless to black crystals of fluorite (I) occur in granular calcite filling vesicles in the black limestone of a quarry at Shipham Gorge, Axbridge. In some specimens the (I) is accompanied by chalcopyrite and black hemispheres of hæmatite. L. S. T.

Formation and stability of muscovite in acid solutions at elevated temperatures. J. W. Gruner (Amer. Min., 1939, **24**, 624—628; cf. A., 1939, I, 345; 1936, 1228).—Experiments in Au-lined bombs in an atm. of CO_2 show that muscovite (I) is unstable in aq. HCl at 300° when the [KCl] falls below a certain limit. Excess of KCl prevents the change of (I) to kaolinite. At 400°, but not at 300°, (I) is formed from Al_2O_3,nH_2O, SiO_2,nH_2O, and KCl in presence of aq. HCl. In hydrothermal solutions, [K$^·$] is of primary importance in the reactions of K$^·$ on K-bearing minerals. L. S. T.

Primary mineralisation at Chuquicamata, Chile. V. M. López (Econ. Geol., 1939, **34**, 674—711).—The structural relations, rock alteration, and sulphide mineralisation of this mine are described. The host rock has the mineralogical characteristics and composition of a granodiorite. The different types of alteration of this rock are illustrated by means of chemical analyses, photomicrographs, and variation diagrams. The most prominent process is the elimination of Na_2O, CaO, and MgO, and the concn. of K_2O and SiO_2. The most prominent minerals formed by the metamorphic processes are sericite and quartz. Enargite is the predominating Cu sulphide in the primary ore, and, in some specimens, forms >90% of the mass. In other specimens, pyrite predominates. Minute amounts of bornite and chalcopyrite are always present. Tennantite and tetrahedrite are also present in certain veins. Molybdenite occurs in quartz veinlets, but the amount of Mo is small (~0·01%); its source is lindgrenite and Mo ochres. A new Mo ochre is described. The paragenesis of the sulphide minerals is discussed. L. S. T.

Montauban mineralised zone, Quebec. F. F. Osborne (Econ. Geol., 1939, **34**, 712—726).—The chief metallic minerals in the Tetreault ore are sphalerite, galena, pyrrhotite, and chalcopyrite. Grey Cu is distributed in minor amounts, and stibnite, molybdenite, electrum, and arsenopyrite occur sporadically. L. S. T.

Geological features of Kolar, Porcupine, and Kirkland Lake. E. Y. Dougherty (Econ. Geol., 1939, **34**, 622—653).—Certain geological features of these pre-Cambrian Au-quartz producing districts are compared. The origin of the lodes is also discussed. L. S. T.

Crystallisation of the Kangasniemi orbicular granite. D. S. Beliankin and V. P. Petrov (J. Geol., 1939, **47**, 769—771; cf. A., 1938, I, 481). L. S. T.

Geology of the crystalline complex of the eastern margin of the Aldan platform. J. K. Dzevanovski (Compt. rend. Acad. Sci. U.R.S.S., 1934, **24**, 447—450). H. J. E.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

APRIL, 1940.

Absorption of hydrogen Lyman radiation by atmospheric gases. S. E. Williams (Nature, 1940, **145**, 68).—The absorption of the H line 1215·7 A. has been measured in N_2, H_2O vapour, O_2, and air. N_2 is transparent in layers $\not> 3·2$ mm. thick at n.t.p., H_2O vapour in a layer 0·05 mm. thick absorbs > half the incident radiation, but O_2 and air absorb $\gg$ was expected. Curves for O_2 and air are reproduced. If 1215·7 A. is emitted from the sun, no absorption will occur until it reaches in the upper atm. levels at which the partial pressure of O_2 is $\sim$0·04 mm. ($\sim$80 km.). L. S. T.

High-frequency discharge with external electrodes. R. Zouckermann (Ann. Physique, 1940, [xi], **13**, 78—150).—A comprehensive investigation of the discharge leads to the following results. The explosive potential curves (except those of H_2) are, in general, similar to those obtained in other types of discharge; the curves for H_2, N_2, and A were accurately obtained. Traces of impurities, in particular Hg, caused marked modifications. For H_2 and N_2, the effect of a fixed amount of Hg vapour decreased, and for A increased, with rise of pressure. The explosive potential is modified by illumination of the discharge tube, especially at low pressures, a phenomenon analogous to the "wall" effect. A spectrographic comparison of the high-frequency with other types of discharge shows that in presence of Hg vapour the gaseous spectra undergo variations comparable with those of their explosive potentials. Results in general can be explained on the distribution of electronic velocities and the form of the excitation functions, the electronic oscillations, and the excitation exchange between excited A atoms and normal Hg atoms. N. M. B.

Excitation conditions of various band systems of the neutral and ionised nitrogen molecule. R. Bernard (Ann. Physique, 1940, [xi], **13**, 5—77).—The divergence of various experimental results on the excitation function of the first negative bands of N_2 is attributed to variations of experimental conditions. The electronic impact method of excitation has led to the solution of problems of the energy levels of the N_2 band systems. The principal results obtained are: a determination of the excitation functions of the N_2 (2*P*) and N_2^+ bands; a study of the relative excitation of the two systems and its relation to the luminescence of N_2 in the aurora; a direct determination of the energies of the $B^3\Pi$ and $C^3\Pi$ levels of the neutral mol., giving the vals. 7·5 and 11 e.v., respectively, in agreement with spectroscopic results; a study and interpretation of the perturbations of the N_2 (2*P*) and N_2 (1*P*) systems under the influence of added monat. gases; excitation of the Vegard-Kaplan bands in pure N_2 and in N_2–A mixtures. N. M. B.

Interpretation of nebular red-shifts. K. R. Popper (Nature, 1940, **145**, 69—70; cf. A., 1939, I, 589). L. S. T.

Magnesium-like spectra of chlorine, potassium, calcium, and scandium. W. L. Parker and L. W. Phillips (Physical Rev., 1940, [ii], **57**, 140—141; cf. A., 1939, I, 227).—Data for λλ, frequencies, intensities, and classifications of $\sim$80 lines of the triplet systems of Cl VI, K VIII, Ca IX, and Sc X are tabulated, and term vals. are reported with respect to the $3s3p^3P_0$ level. N. M. B.

Flame and arc spectra of some calcium and strontium salts. R. K. Asundi and B. K. Vaidya (Nature, 1940, **145**, 224).—The spectra of $CaCl_2$ and especially $SrCl_2$ are mixed with those of the oxides, even when taken with an arc in an atm. of H_2. The anomalous doublet separation of $\sim$600 cm.$^{-1}$ in SrCl (A., 1931, 784) is due apparently to a complicated disposition of oxide and halide bands, and when the former are eliminated the doublet separation becomes $\sim$260 cm.$^{-1}$ Certain other features of the spectra of Ca and Sr salts are due probably to metal mols. of a van der Waals type. L. S. T.

New energy levels in the silver atom. E. Rasmussen (Physical Rev., 1940, [ii], **57**, 243).—Using an arc between pure Ag electrodes, new weak lines, giving new levels, were discovered. Data for λλ, intensities, and classifications of 14 lines, and calc. new terms, including the $d^9s^{2\,2}D$ term, are tabulated. N. M. B.

Zeeman effect in the second and third spectra of xenon. C. J. Humphreys, W. F. Meggers, and T. L. de Bruin (J. Res. Nat. Bur. Stand., 1939, **23**, 683—699).—130 lines of Xe II and 62 lines of Xe III have been observed and measured. Analysis of the observed patterns has allowed computation of 61 *g* vals. associated with Xe II levels and 34 of Xe III levels. The *g*-sum rule has been tested for two different electron configurations in Xe˙. The Landé formula does not represent the observed *g* vals. satisfactorily. For both Xe˙ and Xe˙˙ a vector coupling scheme intermediate between *LS* and *Jj* is indicated. Previous analysis data (A., 1939, I, 166) are revised. W. R. A.

Measurements of the intensity of the principal series of cæsium in the cæsium–neon discharge. M. Beutell (Ann. Physik, 1939, [v], **36**, 533—556).—Relative intensities of the doublets of the 2nd to 6th terms of the principal series of Cs have been measured

by a photographic method. At high Cs pressures the ratios of intensities of the doublet lines for the 2nd, 3rd, and 4th terms becomes independent of pressure and the measured ratios are shown, by comparison with previous experimental vals., to be equal to 2·5th power of the true ratio, r, for an infinitely thin layer. Calc. vals. of r for 2nd, 3rd, and 4th terms are 4·1, 8·7, and 15·6 and estimated vals. for 5th and 6th terms are 50—80 and 110—170, respectively.
O. D. S.

Hyperfine structure of the quadrupole line 2815 A. and of some other lines of ionised mercury. S. MOROZOWSKI (Physical Rev., 1940, [ii], **57**, 207—211).—Most of the lines of the Hg II spectrum excited in a hollow-cathode discharge tube and investigated under high resolving power show complex structure. The components of λλ 2815, 3984, and 2848 A. were measured and the structure was analysed in terms of isotope shift and hyperfine structure. In the case of a forbidden quadrupole line like 2815 A. the intensities of the hyperfine components must be computed by Rubinowicz's formulæ. The hyperfine structure splittings of the levels $6s^2S_{1/2}$, $5d^96s^{2\,2}D_{5/2}$, and $6p^2P_{3/2}$ found experimentally are in agreement with Goudsmit's formulæ and allow in the case of $6s^2S_{1/2}$ level an accurate evaluation of the nuclear g factors for ^{199}Hg. The isotopic shifts in Hg II levels are discussed N. M. B.

Quadrupole and magnetic dipole transition probabilities. G. H. SHORTLEY (Physical Rev., 1940, [ii], **57**, 225—234).—Mathematical. The theory of quadrupole radiation is formulated so as to make available all the methods of computation and sum rules which have been developed for electric-dipole radiation. N. M. B.

Emission of ionising radiations by salts of ordinary metals. E. THIBAUD (Compt. rend., 1940, **210**, 174—175; cf. A., 1939, I, 236).—Absorption measurements in air indicate that Al, Mg, Cr, Mn, and Sb and certain of their oxides and salts emit radiation of λλ 3·1, 3·4, 3·8, 3·9, and 4·9 A., respectively.
A. J. E. W.

Natural width and displacement of spectral lines. J. SERPE (Physica, 1940, **7**, 133—144).—Theoretical. The discrepancy between the results given by the theories of Weisskopf and Wigner and of Kramers is explained. L. J. J.

Striking of the long positive column in rare gases and mercury vapour. G. MIERDEL (Wiss. Veröff. Siemens-Werken, 1939, **18**, Part 3, 68—81).

Positive column of the nitrogen arc at atmospheric pressure. II. A. M. STONE and E. S. LAMAR (Physical Rev., 1940, [ii], **57**, 212—220).—Mathematical. Theory previously reported (cf. A., 1939, I, 439) is extended to include convection in the power loss. N. M. B.

Ultra-violet spectra of 17 Leporis and P Cygni. O. STRUVE and F. E. ROACH (Astrophys. J., 1939, **90**, 727—753).—A comparison of the ultra-violet spectrum of 17 Leporis with that of P Cygni shows that Ti II, Sc II, and Mn II are much enhanced in the former. Si II is relatively weak. 104 lines in the spectrum of P Cygni between 3265 and 4026 A. have been measured and identified. 11 lines are unidentified. Several strong lines are due to Fe III. L. S. T.

Ultra-violet spectra of A and B stars. O. STRUVE (Astrophys. J., 1939, **90**, 699—726).—λλ of numerous absorption lines in the spectra of various A, B, and O stars are tabulated and identified with laboratory lines of the different elements. Photographs of the spectra are reproduced. L. S. T.

Negative ions of hydrogen and the opacity of stellar atmospheres. R. WILDT (Astrophys. J., 1939, **90**, 611—620).—The existence of the negative ions of H in stellar atm. does not support Unsöld's view that the atm. abundance ratio of metals to H is 1 : 50. Observations of the Balmer discontinuity support the ratio of 1 : 10^3 given by Russell and Pannekoek. L. S. T.

Spectra of M supergiant stars. L. SPITZER, jun. (Astrophys. J., 1939, **90**, 494—540).
L. S. T.

Continuous spectrum of stars with extended atmospheres. D. BARBIER and D. CHALONGE (Astrophys. J., 1939, **90**, 627—629).—An extended envelope has been detected in the continuous spectrum near the Balmer limit of ζ Tauri. The presence of H in the photosphere and in the envelope at very low pressures is revealed. L. S. T.

Physical processes in gaseous nebulæ. VIII. Ultra-violet radiation field and electron temperature of an optically thick nebula. L. H. ALLER, J. G. BAKER, and D. H. MENZEL (Astrophys. J., 1939, **90**, 601—610).—The theory of the transfer of radiation developed previously (A., 1940, I, 55) is applied to a numerical example. L. S. T.

[*X*-Ray] **absorption spectra and characteristic levels of uranium, platinum, and tungsten.** (MLLES.) Y. CAUCHOIS and I. MANESCU (Compt. rend., 1940, **210**, 172—174).—λλ of the L absorption discontinuities are recorded; a classification is given, and the energies of the L–P at. levels are derived. " White lines " have been observed on the W- and U-L_{II} and -L_{III} and Pt-L_{III} discontinuities.
A. J. E. W.

First Benedicks effect in gas-free mercury, as influenced by the mean temperature. C. BENEDICKS and P. SEDERHOLM (Nature, 1940, **145**, 148; cf. A., 1938, I, 442).—A re-examination of the effect with a new experimental arrangement has confirmed the positive nature of the effect in gas-free Hg. The effect increases rapidly with a rise in temp. of the metal, and the increase appears to conform to Richardson's law for electron emission from glowing metals.
L. S. T.

Breakdown potentials of gases under alternating voltages. D. O. McCOY (Iowa State Coll. J. Sci., 1939, **14**, 67—68).—Using a spherical discharge tube with spherical Al electrodes, the starting potentials of H_2, N_2, He, and A for five gap distances in the range 10—50 mm. and frequencies 1, 10, 100, and 1000 kc. were determined. The starting potential–pressure curves are given by the Thomson expression for plane parallel electrodes, $V = Ax + B/x$, when this is multiplied by $x^{-\frac{1}{2}}$, a factor probably connected with the type of electrode. Starting potential–

frequency and pressure–gap distance curves are discussed. N. M. B.

Variation of field emission with direction as an example of Bragg interferences in the metal lattice. E. W. Müller (Naturwiss., 1939, **27**, 820—821).—The nature of the directional distribution of the field emission from a W point is discussed from the point of view of interference of electron waves at the metal lattice. A. J. M.

Thermionic emission, migration, and evaporation of barium on tungsten. J. A. Becker and G. E. Moore (Phil. Mag., 1940, [vii], **29**, 129—139; cf. A., 1933, 441).—When Ba is deposited on W, the thermionic activity of the W rises to a max. and then decreases. Contrary to existing views based on emission measurements that the optimum is at approx. a unimol. layer, it is shown that some regions of the filament require >5 times as much Ba as others for optimum emission. Rates of migration and evaporation depend on crystal surface, amount of Ba on the surface, and temp.; rapid migration extends over the range 970—1070° K., and evaporation over 1025—1300° K., both ranges varying probably with O_2 contamination. Measurements of electron emission after all the Ba is evaporated show that the filament was contaminated with an electronegative material, probably O_2. Ba tends to migrate towards the negative end of the filament, thus indicating ionisation of adsorbed atoms. N. M. B.

Radius of the electron and calculation of photo-electric constant of metals. T. Ionescu (Compt. rend., 1940, **210**, 170—172).—A theoretical study of the escape of electrons from a cubic metal lattice, in which the author's expression for the radius of the electron (A., 1936, 1312) is assumed, gives satisfactory vals. for the photo-electric consts. of Li, Na, K, Rb, Cs, Al, Cu, and Ag. A. J. E. W.

Acceleration of electrons in a crystal lattice. W. V. Houston (Physical Rev., 1940, [ii], **57**, 184—186).—Mathematical. The motion of an electron in a periodic potential field, and accelerated by a uniform field, is obtained from the time-dependent Schrödinger equation. N. M. B.

Electron emission at the cathode in the glow discharge. H. Fischer (Naturwiss., 1939, **27**, 838—839).—The electron emission from the cathode in the glow discharge determined from the heating of the cathode does not agree with that determined by other methods. Experiments have therefore been carried out to discover whether the electron emission varies with c.d. and gas pressure. It was found that in the case of H_2 and a brass cathode, the electron emission is governed only by the cathode drop. A. J. M.

Antiferromagnetic transition point of vanadium dioxide. H. Dressnandt and W. Schottky (Naturwiss., 1939, **27**, 840).—The occurrence of a sharp antiferromagnetic transition point is explained by considering peculiarities in the crystal lattice of VO_2. A. J. M.

Distribution of electrons over the section of a gas discharge. V. Fabrikant (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 531—533).—Theoretical. The influence of cumulative ionisation and of vol. recombination on the distribution of electrons has been studied. The first effect is small but the second may become large, especially near equilibrium temp. O. D. S.

Scattering of fast electrons through large angles. A. I. Alichanov, A. I. Alichanian, and M. S. Kozodaev (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 525—527).—The 90° single scattering of electrons from 600 to 2000 ke.v. by celluloid, and by Al, Cu, and Au foils, has been measured. Except in the case of Au, for which scattering is low, results agree with Mott's formula. O. D. S.

At. wt. of holmium. O. Hönigschmid (Naturwiss., 1939, **27**, 855).—Mass spectrograph investigation indicates the unitary nature of Ho, the atom having a mass no. 165. This gives 164·94 for the chemical at. wt., compared with the International val. of 163·5. Analysis of $HoCl_3$, however, gives 164·944, in good agreement with the spectrograph result. A. J. M.

Classification of isotopes. H. Jensen (Naturwiss., 1939, **27**, 841—850; cf. A., 1940, I, 143).—A review dealing with the at. wts. of the lighter nuclei in relation to their binding energies. Similar considerations are applied to the heavier nuclei, although only general conclusions can be reached in this case owing to the fact that the at. wts. are not so accurately known. The abundance of the elements in relation to nuclear stability is considered. Nuclear moments and isotope displacements are also dealt with. A. J. M.

Scattering of slow neutrons by protons. M. S. Plesset and F. W. Brown (Proc. Nat. Acad. Sci., 1939, **25**, 600—604).—Mathematical. The scattering of slow neutrons by protons is considered for the spherical well potential and for the meson type potential. The introduction of the virtual level of the deuteron to describe singlet scattering is also considered. A. J. M.

Proton–proton and proton–neutron interactions for the Morse potential. H. M. Thaxton and A. M. Monroe (Physical Rev., 1940, [ii], **57**, 246; cf. Morse, A., 1937, I, 339).—The consts. of the potential are adjusted to fit recent data and to give agreement with experimentally determined phase shifts and with the slow neutron scattering cross-section. N. M. B.

Total and specific ionisation of Po α-particles and their statistical fluctuations. II. J. M. W. Milatz and G. A. W. Rutgers (Physica, 1940, **7**, 131—132).—Corrections (cf. A., 1939, I, 396). The straggling parameter increases towards a const. val. with increasing strength of source. L. J. J.

β-Radiations of uranium-X_1 and uranium-X_2. J. S. Marshall (Proc. Roy. Soc., 1939, **A**, **173**, 391—410).—The momentum distribution of β-rays from U-X has been investigated, a cloud chamber being used for energies <280 ke.v. and a magnetic spectrometer at larger energies. The β-ray spectrum of U-X_1 extends to ≮265 ke.v. and is interpreted in terms of partial spectra; Fermi distributions with end-points at 130 and 300 ke.v. fit the results. The

continuous distribution of U-X_2 β-rays is interpreted as formed by two partial spectra of the Fermi type. Evidence of the isomerism of the nuclei U-X_2 and U-Z is adduced. G. D. P.

Energies of β-particles from uranium-X_2. D. Roaf (Nature, 1940, **145**, 223, 346).—Measurements with a magnetic spectrometer and coincidence counter give an end-point of the U-X_2 spectrum at 2·3 instead of at 1·66 Me.v. given by the Wilson chamber method. Energy spectra obtained by the latter method should be accepted with reserve. L. S. T.

γ-Radiation of the internal reaction of radium-*E*. E. Stahel and J. Guillissen (J. Phys. Radium, 1940, [viii], **1**, 12—17).—The radiation of the internal reaction of Ra-*E* has been studied experimentally. The qual. and quant. agreement between experimental data and the Knipp–Uhlenbeck theory is good if calculations are based on the experimental distribution of the β-radiation, but if the Fermi theory of this distribution is taken as the basis there is no agreement. W. R. A.

γ-Rays from aluminium due to proton bombardment. G. P. Plain, R. G. Herb, C. M. Hudson, and R. E. Warren (Physical Rev., 1940, [ii], **57**, 187—193; cf. A., 1937, I, 339).—The excitation curve of γ-rays from thin Al films bombarded by 0·46—2·6-Me.v. protons shows a complex system of closely spaced resonances over the entire region. By means of coincidence counters the average energy of the radiation emitted at several of the resonances was measured. N. M. B.

Diffraction spectrography of the γ-radiations of the actinium family. M. Frilley (J. Phys. Radium, 1940, [viii], **1**, 34—40).—The γ-spectra of Ac derivatives have been obtained between 20 and 750 X. using a spectrograph with a revolving crystal. 40 rays correspond with nuclear γ-radiations or with *X*-rays of the fluorescence (*K* spectra) of actiniferous radio-elements or rare earths. The most intense *K* spectrum is that of the element 86 emitted as a result of the disintegration Ac-*X* → An, and not that of element 83 found in the Ra and Th families. The comparison of the energies of γ-radiations by diffraction and by analysis of the α- and β-spectra is difficult owing to the great no. of radio-elements and to the complexity of their spectra. Agreement for λλ <175 X. is satisfactory, but for higher λλ the results are different from those obtained from the β-spectra. This anomaly is considered from the viewpoint of internal conversion coeffs. of the γ-rays. W. R. A.

Use of radioactive isotopes of the common elements in physiology. G. Hevesy (Physical Rev., 1940, [ii], **57**, 240—241).—Arguments against the suggested destructive effect of radiation emitted by radioactive indicators (cf. Barnett, A., 1939, III, 151), with special reference to ^{24}Na and ^{42}K, are discussed. N. M. B.

Groups of protons emitted during the bombardment of hydrogenated substances by the α-radiation from polonium. I. T. San-tsiang (J. Phys. Radium, 1940, [viii], **1**, 1—11).—A detailed account of work already noted (cf. A., 1939, I, 349). W. R. A.

α-Particle groups from the disintegration of beryllium by deuterons. S. K. Allison, E. R. Graves, and L. S. Skaggs (Physical Rev., 1940, [ii], **57**, 158—159).—Using a Smith variable-pressure absorption cell (cf. A., 1939, I, 592) calibrated with a thin Po source, measurements of the energies of the α-particles from the reaction ^{9}Be (*d*, α) ^{7}Li gave curves showing two energy groups 0·31 Me.v. apart and of about equal intensity for 0·326-Me.v. deuterons. Results indicate an excited state of ^{7}Li at 0·48 Me.v., which is probably the same as that appearing in the proton groups from disintegration of ^{6}Li by deuterons. N. M. B.

Energy and half-life of ^{10}Be. E. Pollard (Physical Rev., 1940, [ii], **57**, 241; cf. Allison, A., 1939, I, 292).—Be bombarded with 3·1-Me.v. deuterons gives protons of range 52·6 cm. corresponding with an energy change of 4·52 Me.v. in the reaction $^{9}\text{Be} + \text{D} \rightarrow {}^{10}\text{Be} + \text{H}$. The deduced mass for ^{10}Be is 10·0165±0·0001, and hence the energy difference between ^{10}Be and ^{10}B is ~0·67 Me.v. The upper limit found for the electrons from ^{10}Be is 0·75±0·07 Me.v., and the half-life estimated from the yield is 380 years. N. M. B.

Bombardment of nitrogen and oxygen with protons. S. C. Curran and J. E. Strothers (Nature, 1940, **145**, 224).—Curves showing the excitation functions of the reactions $^{14}\text{N} + {}^{1}\text{H} \rightarrow {}^{15}\text{O} + h\nu$ and $^{16}\text{O} + {}^{1}\text{H} \rightarrow {}^{17}\text{F} + h\nu$, obtained with targets of Na nitride and Al_2O_3, respectively, are reproduced. The yields are $1·5 \times 10^{-11}$ and 8×10^{-12} positron per proton at $0·96 \times 10^{6}$ and $0·95 \times 10^{6}$ v., respectively. L. S. T.

Further applications of the photographic method in nuclear physics. C. F. Powell (Nature, 1940, **145**, 155—157; cf. A., 1939, I, 545).—Results obtained in an examination of the neutrons from F bombarded by 900-kv. deuterons, in which an Ilford half-tone plate with an emulsion 100 μ. thick was used, are reproduced graphically. The spatial orientation of a track in the emulsion can also be determined. The distribution of range with angle for 500 proton tracks scattered by B + D neutrons are given, and show that neutron–proton scattering at high energies can be investigated by the photographic method. Proton tracks attributed to the photo-disintegration of D exposed to γ-rays from proton-bombarded F have also been observed by means of this method. L. S. T.

Resonance phenomena in the disintegration of fluorine by protons. W. E. Burcham and S. Devons (Proc. Roy. Soc., 1939, **A**, **173**, 555—568).—An investigation of the short-range α-particles emitted from F under proton bombardment shows that the resonant γ-radiation is emitted from an excited level of ^{16}O formed after the emission of a low-energy α-particle. The widths of the resonances for γ-radiation were measured and two were found to be very narrow but a third much broader. The excitation function for 5·9-cm. α-particles was

examined; possible explanations of the observed phenomena are discussed. G. D. P.

Transmutation of fluorine by deuterons. J. C. BOWER and W. E. BURCHAM (Proc. Roy. Soc., 1939, **A**, **173**, 379—391).—The energy distribution of the protons emitted by F under bombardment by deuterons of $0{\cdot}8 \times 10^6$ e.v. energy has been measured. Five groups with ranges between 13 and 31 cm. were found. The excitation levels and mass of the radioactive ^{20}F are deduced. A new transmutation of ^{13}C has been detected. G. D. P.

Transmutation of sodium by deuterons. E. B. M. MURRELL and C. L. SMITH (Proc. Roy. Soc., 1939, **A**, **173**, 410—417).—Bombardment by deuterons of $0{\cdot}85 \times 10^6$ e.v. energy produces α-particles with ranges of 5·0 and 3·4 cm. These are attributed to the process $^{23}Na + {}^2H \rightarrow {}^{21}Ne + {}^4He$. Four groups of protons were also found. The masses of ^{23}Na and ^{24}Na and ^{24}Mg are deduced. G. D. P.

Energy levels, mass, and radioactivity of ^{41}A. W. L. DAVIDSON, jun. (Physical Rev., 1940, [ii], **57**, 244—245; cf. A., 1940, I, 52).—Bombardment of A with 2·38-Me.v. deuterons gives rise to proton groups of ranges 27, 35·75, and 53 cm., and respective *Q* vals. 2·23, 3·01, and 4·37 Me.v. The probable reaction is $^{40}A + {}^2H \rightarrow {}^{41}A + {}^1H$. Results infer excited states in the ^{41}A nucleus at 1·36 and 2·14 Me.v., and a mass val. $40{\cdot}9770 \pm 0{\cdot}0006$. The val. calc. for ^{41}Ca from the Ca (*d*, *p*) reaction is 40·9736. Assuming that ^{41}A emits a 1·5-Me.v. β-ray going to an excited state at 1·37 Me.v. in ^{41}K, the above mass for ^{41}A establishes $40{\cdot}9739 \pm 0{\cdot}0008$ for ^{41}K (cf. Richardson, A., 1937, I, 59). The reported 5-Me.v. electron group (cf. *ibid.*) cannot be due to ^{41}A. N. M. B.

Nuclear isomerism in selenium and krypton. A. LANGSDORF, jun., and E. SEGRÈ (Physical Rev., 1940, [ii], **57**, 105—110; cf. Snell, A., 1938, I, 8).—An investigation of the radioactive chain $^{83}Se \rightarrow {}^{83}Br \rightarrow {}^{*83}Kr \rightarrow {}^{83}Kr$ by deuteron bombardment of Se leads to an identification of an excited state ($^{*83}Kr$) of the stable ^{83}Kr, the identification and chemical separation of an isomeric pair $^{79 \text{ or } 81}Se$, and confirmation of ^{83}Se (half-life ~30 min.). ^{83}Kr and ^{83}Br are produced by the fission of U and Th as well as by bombardment of Se by deuterons and slow neutrons. N. M. B.

Radioactive isotopes of (A) scandium and their properties, (B) calcium and their suitability as indicators in biological investigations. (A) H. WALKE. (B) H. WALKE, F. C. THOMPSON, and J. HOLT (Physical Rev., 1940, [ii], **57**, 163—171, 177—184; cf. A., 1937, I, 213).—(A) The 57 ± 2-min. activity (formerly 53 ± 3 min.), produced by bombarding Ca with deuterons, which emits $1{\cdot}8 \pm 0{\cdot}1$-Me.v. β-particles and was assigned to ^{41}Sc is probably ^{49}Sc. ^{49}Sc can be produced by the decay of ^{49}Ca and from Ti by bombardment with fast neutrons; it emits no γ-radiation. ^{42}Sc ($13{\cdot}4 \pm 0{\cdot}3$ days) emits positrons of max. energy $1{\cdot}4 \pm 0{\cdot}1$ Me.v. The complex continuous spectrum of ^{43}Sc shows two groups of positrons and $1{\cdot}0 \pm 0{\cdot}1$-Me.v. γ-radiation. ^{44}Sc (52 hr.) is a metastable form decaying by emitting highly internally converted 250-ke.v. γ-radiation. The only form of ^{46}Sc (85 ± 1 days) emits $0{\cdot}26 \pm 0{\cdot}01$-Me.v. β-rays (> 95%), and $1{\cdot}5 \pm 0{\cdot}1$-Me.v. (<5%) and $1{\cdot}25 \pm 0{\cdot}1$-Me.v. γ-rays. ^{47}Sc (63 ± 2 hr.) emits $1{\cdot}1 \pm 0{\cdot}1$-Me.v. β-rays. ^{48}Sc (44 ± 1 hr.) emits $0{\cdot}5 \pm 0{\cdot}1$-Me.v. β-rays (~90%), and $1{\cdot}4 \pm 0{\cdot}1$-Me.v. (~10%) and $0{\cdot}9 \pm 0{\cdot}1$-Me.v. γ-rays. The following new reactions were established: $^{48}Ca + {}^2H \rightarrow {}^{49}Sc + {}^1n$; $^{49}Sc \rightarrow {}^{49}Ti + e^-$; $^{49}Ti + {}^1n \rightarrow {}^{49}Sc + {}^1H$; $^{39}K + {}^4He \rightarrow {}^{42}Sc + {}^1n$; $^{42}Sc \rightarrow {}^{42}Ca + e^+$; $^{43}Ca + {}^4He \rightarrow {}^{46}Sc + {}^1H$; $^{46}Sc \rightarrow {}^{46}Ti + e^-$; $^{44}Ca + {}^4He \rightarrow {}^{47}Sc + {}^1H$; $^{47}Sc \rightarrow {}^{47}Ti + e^-$.

(B) ^{49}Ca (2·5 hr.) was previously attributed to ^{45}Ca; it probably exists in two isomeric forms of half-lives 30 ± 1 min. and $2{\cdot}5 \pm 0{\cdot}1$ hr. ^{49}Ca (2·5 hr.) gives rise to ^{49}Sc (57 ± 2 min.) and emits electrons of max. energy $2{\cdot}3 \pm 0{\cdot}1$ Me.v., the end-point at $1{\cdot}8 \pm 0{\cdot}1$ Me.v. being probably due to the ^{49}Sc in equilibrium with its parent. ^{49}Ca (2·5 hr.) emits $0{\cdot}8 \pm 0{\cdot}1$-Me.v. γ-rays. ^{41}Ca ($8{\cdot}5 \pm 0{\cdot}8$ days) decays by *K*-electron capture and emits $1{\cdot}1 \pm 0{\cdot}1$-Me.v. γ-ray which is internally converted to $\sim 10^{-3}$. ^{41}Ca was produced by the reactions $^{40}Ca + {}^2H \rightarrow {}^{41}Ca + {}^1H$; $^{42}Ca + {}^1n \rightarrow {}^{41}Ca + 2{}^1n$. ^{45}Ca (180 ± 10 days) emits $0{\cdot}19 \pm 0{\cdot}01$- (95%) and $0{\cdot}91 \pm 0{\cdot}03$-Me.v. (5%) electrons and $0{\cdot}71 \pm 0{\cdot}03$-Me.v. γ-rays; it was formed in the reactions $^{44}Ca + {}^2H \rightarrow {}^{45}Ca + {}^1n$; $^{44}Ca + {}^1n \rightarrow {}^{45}Ca + \gamma$; $^{45}Sc + {}^1n \rightarrow {}^{45}Ca + {}^1H$. It is concluded that only ^{45}Ca is likely to prove useful as a radioactive indicator. Ca bombarded with fast neutrons gives an unidentified $4{\cdot}5 \pm 0{\cdot}5$-min. activity. N. M. B.

Radioactivity of ^{56}Mn. R. H. BACON *et al.* (Physical Rev., 1940, [ii], **57**, 240; cf. A., 1940, I, 50).—A correction. For mc^2 read mc. N. M. B.

***K*-Electron capture and internal conversion in ^{51}Cr.** H. WALKE, F. C. THOMPSON, and J. HOLT (Physical Rev., 1940, [ii], **57**, 171—176).—^{47}V (cf. A., 1939, I, 443) was not confirmed. ^{51}Cr ($26{\cdot}5 \pm 1{\cdot}0$ days) was chemically isolated from Ti bombarded with high-speed α-particles, and from Cr activated with deuterons; its identification depends on its formation in the reactions $^{48}Ti + {}^4He \rightarrow {}^{51}Cr + {}^1n$; $^{50}Cr + {}^2H \rightarrow {}^{51}Cr + {}^1H$; $^{50}Cr + {}^1n \rightarrow {}^{51}Cr + \gamma$. ^{51}Cr decays mainly by *K* electron capture, but is probably unstable against positron emission as it emits strong 0·5- and 1·0-Me.v. γ-radiation. No positrons of energy >0·1 Me.v. were detected, the lower limit of the ratio *K* capture to emission of positrons of energy >0·1 Me.v. being 10,000. A nuclear transition in ^{51}V gives the 1·0-Me.v. γ-ray which is internally converted to 0·1%, the conversion electrons being found by absorption measurements. A strong source of ^{51}Cr also emits $0{\cdot}35 \pm 0{\cdot}05$-Me.v. electrons, which are probably recoil electrons due to the 0·5-Me.v. γ-rays. N. M. B.

Internal conversion in 6·4-hour Cd. R. G. SACHS (Physical Rev., 1940, [ii], **57**, 159—160).—Mathematical. It is shown that the ratio of the no. of *L* to *K* conversions for the 92-ke.v. γ-ray in 6·4-hr. Cd and ^{67}Ga, respectively, is consistent with theory. (Cf. Valley, A., 1940, I, 4.) N. M. B.

Production of radium-*E* and polonium by deuteron bombardment of bismuth. D. G. HURST, R. LATHAM, and W. B. LEWIS (Proc. Roy. Soc., 1940, **A**, **174**, 126—136).—The bombardment of

Bi by deuterons up to 8·7 Me.v. energy is accompanied by the formation of Ra-*E* and Po; the former decays with emission of an electron to Po with half-life of 5 days. The relative yields of the two reactions are determined for various energies of the deuterons. The excitation functions are compared with those predicted by theory. G. D. P.

Transmutation products from uranium bombarded with neutrons. W. Jentschke and F. Frankl (Physikal. Z., 1939, **40**, 706—713).—The conditions necessary for obtaining accurate results in the detection of transmutation products from U are outlined and an experimental arrangement is described. The energy and range of the transmuted particles when U is bombarded with neutrons are obtained. The max. energy of the particles is 108 Me.v. Tho effective neutron energies for bringing about the transmutation are considered, and the energy distribution for irradiation with rapid and slow neutrons is obtained. A. J. M.

Liberation of neutrons in the nuclear explosion of uranium irradiated by thermal neutrons. T. Hagiwara (Rev. Phys. Chem. Japan, 1939, **13**, 145—150, and Mem. Coll. Sci. Kyoto, 1940, **A, 23**, 19—32).—The absorption of thermal neutrons when U is irradiated brings about emission of secondary non-thermal neutrons which possess a kinetic energy of ~10 Me.v. and of which an average of 2·6 are emitted for each thermal neutron absorbed. C. R. H.

Non-existence of transuranic elements. L. A. Turner (Physical Rev., 1940, [ii], **57**, 157).—The fact that the periodic table ends with the only element giving nuclear fission with thermal neutrons is a probable clue to the explanation of the missing atoms. The possible production and modes and periods of disintegration of ^{239}U, ^{233}U, and ^{233}Pa are discussed. N. M. B.

Formation and fission of transuranium nuclei. V. E. Polesitski and K. A. Petrjak (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 854).—50 g. of U [salt] were bombarded by slow neutrons from a cyclotron for 20 hr. and then dissolved in HCl. A few mg. of PtS_2 were pptd. together with all the trans-U elements (if present). The ppt., measured on a Geiger–Müller counter, gave several hundreds of impulses per min.; the same ppt. placed in an ionisation chamber gave no effect within two hr. This shows that if trans-U elements are formed, after which they undergo fission, the effective cross-section for this process must be $\ll$ that of the U fission, and $\not> 10^{-28}$ sq. cm. W. R. A.

Chemical nature of the product of the rupture of uranium nuclei by neutrons. I, II. V. G. Chlopin, M. A. Pasvik-Chlopin, and N. F. Volkov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 847—850, 851—853).—I. Among the products of the rupture of U by neutrons have been found two isotopes of Sr (one with half-life period, τ, ~7 hr. 30 min., and the other with a much greater τ), two I isotopes (τ ~3·8 and 28 hr.) and possibly a third with a much greater τ, and two Br isotopes (τ ~90 min. and ~15 hr.). The appearance of halogen isotopes in the transformation products suggests that mechanisms of the rupture other than have been proposed are possible.

II. The presence of two isotopes of Sb (τ ~12 min. and ~17 hr.) and a Te isotope (τ ~56 hr.) have been detected in the products of the rupture of U by neutrons. Another product has τ ~60 days and this is considered to be a Ra-Sb. W. R. A.

Fission of uranium nuclei. N. F. Volkov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 528—530).—The residual radioactivity of U compounds after a period of irradiation with neutrons has been studied. O. D. S.

Transition maximum according to the data of observations from substratostats. S. N. Vernov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 859—862).—Intensity of cosmic radiation at an altitude of 8—10 km. has been measured using a Geiger–Müller counter, and results obtained during two substratostat flights confirm the contradictions between the cascade theory without accounting for scattering and experimental data. W. R. A.

Certain divergencies between experimental data and deductions from the Bhabha–Heitler–Arley cascade theory. S. N. Vernov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 863—867).—By taking scattering and the presence of a large no. of low-energy electrons in the spectrum of particles in the cascade into account, it is concluded that the discrepancy (cf. preceding abstract) between experimental and theoretical results can be explained, while still retaining the physical basis of the cascade theory. Other effects are also explained. W. R. A.

Variations of the hard components of cosmic rays. E. Regener and W. Rau (Naturwiss., 1939, **27**, 803—805).—The periodic variations of the intensity of the hard components of cosmic rays have been examined. A double daily periodicity was found with two max. and min. of almost equal height. The max. occur at 9—11 hr. and 22—23 hr. The double period can be connected with other terrestrial electrical and magnetic phenomena. A double daily variation in the height of the isobar from which the mesotrons originate could explain the phenomena, but it appears that such variation is not great enough to account for the observed effect. A. J. M.

Multiple transmutation of atomic nuclei by cosmic rays. G. Stetter and H. Wambacher (Physikal. Z., 1939, **40**, 702—706).—Photographic plates were exposed at various heights, and the no. and energy of the particles, probably arising from nuclear processes, were deduced. The "stars" produced on the plate have been analysed. A. J. M.

Contributions of showers to the coincidences recorded at high elevations. T. H. Johnson and J. G. Barry (Physical Rev., 1940, [ii], **57**, 245—246).—A discussion of results previously reported (cf. A., 1939, I, 506). It is concluded that mesons are not produced by rays of the soft component but are probably produced by primary protons. N. M. B.

Scattering of mesotrons in metal plates. J. G. Wilson (Proc. Roy. Soc., 1940, **A**, **174**, 73—85).—A series of accurate measurements is described which confirm the theory of scattering taking account

of the finite size of the nucleus. The evidence for the existence of large-angle scattering due to short-range forces between mesotrons and nuclear protons and neutrons is discussed. There is no experimental evidence for the large increase of scattering due to short-range forces at low mesotron energies given by the quantum-mechanical treatment. G. D. P.

Mesotron lifetime. W. M. NIELSEN, C. M. RYERSON, L. W. NORDHEIM, and K. Z. MORGAN (Physical Rev., 1940, [ii], **57**, 158).—Measurements of absorption curves of vertical cosmic rays at two elevations at two separate localities, with compensation for atm. pressure differences, give results strongly supporting the mesotron decay hypothesis, and lead to the val. $1\cdot2 \times 10^{-6}$ sec. for the mesotron lifetime and 7×10^{5} cm. for the mean path (cf. Rossi, A., 1940, I, 5). N. M. B.

Production of soft secondaries by mesotrons. J. R. OPPENHEIMER and H. SNYDER (Physical Rev., 1940, [ii], **57**, 75—81).—Mathematical. An examination of experimental evidence in relation to theory as applicable for various energy limits in an attempt to explain cosmic-ray secondaries and bursts. N. M. B.

Does the mesotron obey Bose–Einstein or Fermi–Dirac statistics? P. L. KAPUR (Nature, 1940, **145**, 69).—By assuming that the field responsible for the interaction between elementary nuclear particles is a two-particle field, so that a mesotron is always emitted or absorbed in conjunction with a neutrino or antineutrino, it is possible to derive the forces between the particles and to explain β-disintegration. L. S. T.

Large cosmic-ray showers and mesons. A. H. WILSON and F. BOOTH (Nature, 1940, **145**, 103—104).—The probability that, when a fast meson collides with a nucleus, an energetic γ-ray will be emitted is calc. The formation of cascade showers is discussed. L. S. T.

Evidence for transformation of mesotrons into electrons. E. J. WILLIAMS and G. E. ROBERTS (Nature, 1940, **145**, 102—103, 151).—Photographs showing a fast electron track emerging from a mesotron track in a specially-constructed cloud-chamber are reproduced. This indicates that the mesotron is identical with the hypothetical particle assumed in Yukawa's theory of nuclear forces and β-disintegration. L. S. T.

Proton–deuteron transformation as a source of energy in dense stars. W. A. WILDHACK (Physical Rev., 1940, [ii], **57**, 81—86).—Mathematical. The rates of energy evolution due to the transformation to He, starting with the reaction $H + H = D + e^{+}$ (cf. Bethe, A., 1938, I, 550), in H_2 at densities 10^{4}—10^{8} g. per c.c., are calc. on the basis of complete degeneracy, and the assumption of a crystal-like spacing of the protons. Difficulties in interpreting the energy of the white dwarf stars as due to the presence of H_2 or ^{3}He are discussed. N. M. B.

Interaction between radiation and matter. K. C. KAR (Phil. Mag., 1940, [vii], **29**, 169—184).—Mathematical. A discussion of quantum theories of interaction from the point of view of wave statistics. N. M. B.

Excitation of inner electrons in zinc, cadmium, and mercury by electron impact. A. H. LEE (Proc. Roy. Soc., 1939, **A**, **173**, 569—580).—The energy losses of a beam of electrons of 200 v. energy during its passage through vapours of Zn, Cd, and Hg were recorded and lead to the detection of certain ultra-ionisation potentials. These are shown to be due to the excitation of an inner electron. G. D. P.

Photodisintegration of the deuteron in the meson theory. H. FRÖLICH, W. HEITLER, and B. KAHN (Proc. Roy. Soc., 1940, **A**, **174**, 85—102).—The theory takes account of the direct interaction of the light quantum with the protons and with the charged nuclear field. On account of the small mass of the meson the effect of the interaction with the field is preponderant at high energies. It is suggested that it should be possible to check the predictions of the theory experimentally and to devise a crucial test of the present form of the meson theory. G. D. P.

Rest mass of the electron. W. RUPPEL (Ann. Physik, 1939, [v], **36**, 521—532).—Mathematical. The empirical formula of Du Mond (A., 1938, I, 115) for the Rydberg const. could be interpreted on the hypothesis that the rest mass of the electron depends on its acceleration. A dependence of the required magnitude cannot be deduced from Scherzer's theory of the electron (cf. A., 1940, I, 89). O. D. S.

Stable atomic nuclei and the present position as regards their classification. H. JENSEN (Naturwiss., 1939, **27**, 793—803).—The conditions of stability of at. nuclei are discussed. The rules governing the existence of isobares (Mattauch's rule, Harkins' rule) and the distribution of isotopes are considered. Apparent deviations from Mattauch's rule are examined. It is shown that the rule excludes the possibility of stable nuclei of at. no. 43 and 61. A. J. M.

Quantitative determination of the neutron moment in absolute nuclear magnetons. L. W. ALVAREZ and F. BLOCH (Physical Rev., 1940, [ii], **57**, 111—122).—The method, the theory of which is developed in detail, is an extension of the magnetic resonance method for nuclear magnetic moments (cf. Rabi, A., 1939, I, 297). In place of deflexion by inhomogeneous magnetic fields, magnetic scattering is used to produce and analyse the polarised beam of neutrons. The neutron moment is found directly from the frequency and field when resonance is observed, with the assumption of neutron spin $\frac{1}{2}$; the val. from a series of experiments is $1\cdot93_5 \pm 0\cdot02$ abs. nuclear magnetons. A new method of evaluating the magnetic moment of any nucleus by the resonance is described. The moment is determined directly in abs. units from measurements of the ratio of two magnetic fields. N. M. B.

Magnetic moment of the neutron. O. HALPERN and M. H. JOHNSON (Physical Rev., 1940, [ii], **57**, 160).—Discrepancies between the calc. influence of magnetisation on the transmission of neutrons through polycryst. Fe and that calc. for randomly oriented

atoms may be due to uncertainties in the theoretical data due to the use of an unsuitable form factor or to the need for a revised val. of the spin and moment of the neutron (cf. A., 1939, I, 397), and consequences of this are discussed. N. M. B.

Magnetic moments of light nuclei. M. PHILLIPS (Physical Rev., 1940, [ii], 57, 160—161; cf. Millman, A., 1939, I, 512; Rose, A., 1940, I, 54).—Mathematical. Discrepancies between calc. and experimental vals. of nuclear magnetic moments may be due to oversimplifying assumptions in the theory of the ground state of the various nuclei. N. M. B.

Nuclear isomerism. R. G. SACHS (Physical Rev., 1940, [ii], 57, 194—197).—Mathematical. It is suggested that nuclear isomerism may be due to the fact that the two lowest nuclear states have zero angular momentum and opposite parity. The life-time of the first excited state is estimated under these conditions for the emission of two quanta and for the ejection of two electrons from the *K* or *L* shell. The possibility of distinguishing experimentally between this hypothesis and that of Weizsäcker is discussed. N. M. B.

(A) **New derivation of the quadratic equation for the masses of the proton and electron.** (B) **Masses of the neutron and mesotron.** (SIR) A. S. EDDINGTON (Proc. Roy. Soc., 1940, A, 174, 16—41, 41—49).—(A) The introduction of an improved method simplifies the derivation of the fundamental quadratic $m_0^2 + 10m^2 = 136mm_0$, the roots of which give the ratio of the masses of proton and electron.

(B) The ideas developed in (A) are used to calculate the mass of a neutron, which is found to exceed that of a H atom by ~1·5 electron masses. The mass of the mesotron is found to bo 174·44 standard electron masses and it appears that a "heavy mesotron" may exist with a mass of 2·36 proton masses. A rough estimate of the life-time of a mesotron is obtained. The results are discussed in relation to their bearing on nuclear structure; it appears that mesotrons have no connexion with the so-called Yukawa particles. G. D. P.

Neutron–deuteron scattering cross-section. L. MOTZ and J. SCHWINGER (Physical Rev., 1940, [ii], 57, 161—162).—Mathematical. The elastic scattering cross-section of neutrons by deuterons is calc. for energies so small (thermal neutrons) that only the *s* part of the incident wave is appreciably different from the corresponding part of a plane wave. The val. found is $4·57 \times 10^{-24}$ sq. cm., or ~20% > experimental, a difference possibly due to polarisation effects. N. M. B.

Proton–proton scattering. K. C. KAR and D. BASU (Phil. Mag., 1940, [vii], 29, 200—204).—Mathematical. A treatment by the wave-statistical method. N. M. B.

Interaction potential in the scattering of protons by protons. (SIR) A. S. EDDINGTON and H. M. THAXTON (Physica, 1940, 7, 122—124).—Theoretical. L. J. J.

Series in nuclear energy levels. K. M. GUGGENHEIMER (Nature, 1940, 145, 104—105).—The term law of the rigid rotator of quantum mechanics can be applied to the known nuclear energy levels of ^{10}B, ^{26}Mg, and ^{223}Ac-*X*. In accordance with the assumption of equal ρ, the $\frac{5}{3}$ powers of the mean vals. of *I* of these three at. nuclei are, within 1%, ∝ the at. wts. L. S. T.

Validity of the *X*-ray crystal method for determining *N* and *e* with aluminium, silver, and quartz. P. H. MILLER, jun., and J. W. M. DU MOND (Physical Rev., 1940, [ii], 57, 198—206).—Objections to the method arise from the possible presence of a mosaic effect or superstructure and from the *X*-ray measurement of the lattice const. of only a superficial layer. The structure of polycryst. Ag and Al and of single-crystal powdered quartz was precisely measured. The crystallites were small enough for complete penetration by the radiation, and the effect of distortion of the metal crystals on the density and structure was investigated. A comparison of the vals. found for *N* and *e* with those of Tu (cf. A., 1932, 796) indicates a possible small mosaic effect rendering the vals. uncertain by 0·04% and that the best val. of *e* is $4·801 \pm 0·002 \times 10^{-10}$ e.s.u., or slightly < that obtained with macroscopic calcite. N. M. B.

Simple rule for evaluating atomic constants. P. WOO (Nature, 1940, 145, 30—31).—Vals. of *h*, *e*, *m*, mass of H, *e/m*, and *h/e*, calc. from the equations given and the experimental vals. of *c*, Rydberg's const., and *g*, are compared with observed vals. L. S. T.

Determination of *h/e* by the method of isochromats. P. OHLIN (Nature, 1940, 145, 223).—The shape and position of the isochromats are sensitive to the pressure in the *X*-ray tube; this may account for the discrepancies in the vals. of *h/e* obtained by this and other methods. L. S. T.

Dissociation scheme for some diatomic hydride and deuteride molecules. L. GERÖ (Physica, 1940, 7, 155—168).—New data are recorded for the $A^2\Delta \rightarrow X^2\Pi$ (0, 0) and (1, 1) bands of CH. The $A^2\Delta$ term has a predissociation limit at 29,500 cm.$^{-1}$, at the most probable energy level for the convergence limit of the $B^2\Sigma$ state. A dissociation scheme in agreement with the observed predissociation, perturbation, and isotope effects for CH and CD is given. Similar schemes agree with existing data for SiH, SnH, and PbH. L. J. J.

Atmospheric oxides of nitrogen. A. ADEL (Astrophys. J., 1939, 90, 627).—Curves supporting the view that the new band described previously (A., 1938, I, 342; 1939, I, 59) is produced by joint absorption by N_2O and N_2O_5 are reproduced. L. S. T.

Cyanogen discriminant between giant and dwarf stars. D. HOFFLEIT (Astrophys. J., 1939, 90, 621—624).—Examination of the CN band at 4144—4184 A. for 128 stars of spectral classes G and K indicates that the CN criterion discriminates between normal giant and dwarf stars. L. S. T.

Photometric study of the ultra-violet absorption spectrum of nitrous oxide at the temperatures 20° and —90° C. J. NICOLLE and B. VODAR (Compt. rend., 1940, 210, 142—144).—

Measurements at 2150—2350 A. with 70—574-cm. layers of N_2O at 100—760 mm. pressure (p) show that the absorption is independent of p; the log ϵ/λ curves (ϵ = mol. extinction coeff.) for the temp. given are linear and parallel, with $\epsilon_{20°}/\epsilon_{-90°} = 2{\cdot}95$. At −90° the absorption originates at 2350 A.; the region forms a branch of the band at 1900 A. reported by Duncan (A., 1937, I, 7). The absorption is due to the process $N_2O + h\nu = NO + N\ (^4S)$; this and other processes giving $NO^* + N\ (^2D)$ and $NO + N\ (^2P)$ account for the A-, B-, and C-bands in the Schumann region. The N_2O mol. has excited vibrational states at room temp. A. J. E. W.

Valency angles and absorption spectra. (MME.) P. RAMART-LUCAS (Atti X Congr. Internaz. Chim., 1938, III, 347—357).—The studies of the author and her co-workers are summarised. Changes in valency angles produced by the formation of closed rings or by the presence of radicals with branched chains lead to changes in the absorption spectrum and in the reactivity of the mol. The decrease in reactivity of certain groups usually attributed to steric hindrance is caused to a considerable extent, if not entirely, by coupling between the active group and the radicals or by deformation of valency angles. Since modification of the valency angle can produce either an increase or a decrease of reactivity, this view explains many facts which appear contradictory on the steric hindrance hypothesis. J. W. S.

Absorption spectra of neodymium and samarium acetylacetonates in different solvents. (MLLE.) M. RADOÏTCHITCH (Ann. Chim., 1940, [xi], **13**, 5—87).—A detailed account of work already noted (cf. A., 1938, I, 227). W. R. A.

Chemical war materials. XIII. Light absorption of tear gases in the short-wave ultraviolet. XIV. Spectroscopic determination of war materials. W. MOHLER and J. SORGE (Helv. Chim. Acta, 1940, **23**, 100—103, 104—119).—XIII. Absorption data for C_6H_{14} solutions of five tear gases are recorded. Over the ultra-violet band studied, absorption max. (in mμ.) occur at the following λλ: CH_2AcBr 299, 215; $CH_2Br{\cdot}COEt$ 301, 213; CH_2BzCl 329, 291, 280, 246, 198; CH_2BzBr 331, 250, 197; CH_2PhBr 227, 194; $C_6H_4Me{\cdot}CH_2Br$ 233, 199; $CHPhBr{\cdot}CN$ 330, 315, 242.

XIV. Collected spectroscopic data for 17 war gases record, in addition to those preceding, the following absorption max. Nose and throat irritants: $AsPh_2Cl$ 351, 268—270; $AsPh_2{\cdot}CN$ 270, 254, 242, 227; phenarsazine chloride 357, 306, 276, 248, 233, 220, 198; lung poisons: $CCl_3{\cdot}NO_2$ 276, 205; $ClCO_2CCl_3$ gave no max.; vesicants: $AsEtCl_2$ 241; $AsCl_2{\cdot}CH{:}CHCl$ 214; $AsCl(CH{:}CHCl)_2$ 209; $As(CH{:}CHCl)_3$ 207; $(Cl{\cdot}[CH_2]_2)_2S$ 202. The calculation of the concn. in the air of gas and gas mixtures from spectroscopic data is illustrated, and a table gives the smallest amount of each of the 17 gases detectable by this method. C. R. H.

Light absorption of some derivatives of bacteriochlorophyll. A. STERN and F. PRUCKNER (Z. physikal. Chem., 1939, **185**, 140—151).—Extinction curves in the visible and ultra-violet are given for a no. of derivatives of bacteriochlorophyll, and compared with those for the corresponding chlorophyll derivatives. They show close similarity in the ultra-violet, but greater differences in the visible. F. J. G.

Dichroism of an iodoform crystal in the infra-red. Y. TA (Compt. rend., 1939, **209**, 990—992).—The CH band at 17,175 A. in the absorption spectrum of an CHI_3 crystal disappears when the crystal axis is parallel to the incident light beam, but reappears when the crystal is tilted. The CH linking and its direction of vibration are thus parallel to the crystal axis, and absorption at the CH ν occurs only if the electric vector of the light beam has a component in this direction. The CH deformation vibration remains depolarised in absorption. A. J. E. W.

Infra-red study of chloral hydrate and related compounds. M. M. DAVIES (Trans. Faraday Soc., 1940, **36**, 333—344).—The absorption spectra of $CCl_3{\cdot}CH(OH)_2$ (I), $CBr_3{\cdot}CH(OH)_2$ (II), $OH{\cdot}CHPh{\cdot}COPh$ (III), and o-$C_6H_4Br{\cdot}OH$ (IV) in the region 2·6—3·0 μ., and of (I) and $CCl_3{\cdot}CO_2H$ (V) in the regions 7·5—8·5 μ. and 12—15 μ., have been examined. (I) has the OH band at 2·82 μ., and (II) at 2·81 μ. with indications of a subsidiary max. at 2·76 μ. This suggests that in (I) the free rotation of the H atoms about the C–O linking is inhibited by interaction with Cl atoms, whereas in (II) there is a small proportion of "free" OH groups, corresponding with its lower stability. Evidence for the effect of this interaction on the valency vibrations of the CCl_3 group is obtained from the comparison of the spectra of (I) and (V). (III) shows broad bands at 2·78 and 2·89 μ., attributed to two different orientations of the OH with respect to the C:O, and (IV) shows bands at 2·84 and 2·785 μ., corresponding with *cis*- and *trans*-forms differing in energy by ~800 g.-cal. per g.-mol. The relationship between energy differences and frequency changes in the OH group is discussed, and it is shown that observed behaviour can often be accounted for by calculating the energies of interactions involving the OH group electrostatically, so that the resonance contribution to H bonding is often quite small. F. J. G.

Infra-red absorption spectrum of methylamine vapour. C. R. BAILEY, S. C. CARSON, and E. F. DALY (Proc. Roy. Soc., 1939, **A**, **173**, 339—348).—The spectrum has been recorded in the range λ = 1—26·5 μ., and the fundamental modes and combination tones have been assigned. The experimental results suggest a mol. analogous to the D_{3h} model for C_2H_6. Inclusion of an indirectly determined torsional frequency permits the sp. heat to be calc. G. D. P.

Determination of integral extinction equivalents of liquid hydrocarbons by means of absorption measurements in the infra-red spectrum. R. SUHRMANN and P. KLEIN (Atti X Congr. Internaz. Chim., 1938, II, 525—533).—Measurements of the extinction coeffs. of liquid C_5H_{12}, C_6H_{14}, and C_7H_{16} in the region 1·2 μ. have been made. The area of an absorption band, *i.e.*, the integral extinction coeff. (E), is characteristic of a

particular linking. Using the vals. of E characteristic of the CH linking for the absorption band at 1·20 μ. in aliphatic and at 1·14 μ. in aromatic hydrocarbons, E vals. of other aliphatic and aromatic compounds can be calc. O. J. W.

Absorption spectrum of pyrrole, thiophen, and furan in the middle infra-red. R. Manzoni-Ansidei and M. Rolla (Atti X Congr. Internaz. Chim., 1938, II, 320—324).—Data for the region 600—1500 cm.$^{-1}$ are recorded. Comparison with Raman spectrum data does not confirm the C_{2v} symmetry for the above-mentioned mols. O. J. W.

Water vapour molecule. B. T. Darling and D. M. Dennison (Physical Rev., 1940, [ii], **57**, 128—139).—Mathematical. The vibration rotation spectrum is treated by the theory of semi-rigid polyat. mols. There is no discrepancy between Raman and infra-red spectra. Effective moments of inertia are calc. The analysis of the rotational structure is supplemented by taking account of the rotational stretching. The resulting mol. consts. give the valency angle 104° 31′ and the O—H distance 0·9580 A. Results in general are in close accord with experiment. N. M. B.

Combination scattering of solutions in heavy water. G. S. Landsberg, V. I. Malischev, and V. E. Soloviev (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 872—873).—The D_2O spectrum is characterised by a strong band similar to that observed for OH in H_2O but displaced to lower νν due to the greater mass of D. The max. of the OD band is at 2535 cm.$^{-1}$ A 3% solution of D_2O in H_2O causes the band to become narrower and to be displaced to higher νν (2560 cm.$^{-1}$). A 3% solution of D_2O in $COMe_2$ shifts the max. of OD to 2600 cm.$^{-1}$ and the band narrows. Thus, the resonance effect is important in the perturbations of the OD (or OH) group. The O in the H_2O and D_2O must have identical electron configurations and its perturbation action on the oscillation of OD of D_2O mols. must be the same irrespective of whether the solvent is D_2O or H_2O. From the viewpoint of reciprocal action of resonance, however, there is a difference depending on whether the D_2O mols. are surrounded by H_2O or D_2O mols. The action of H_2O mols. on the oscillations of OD is probably similar to that of $COMe_2$ and other mols. containing O. W. R. A.

Raman spectrum of neutral tungstates in the crystalline state and in aqueous solution. (Mlle.) M. Théodoresco (Compt. rend., 1940, **210**, 175—177; cf. A., 1936, 1445; 1938, I, 555).—The following Raman νν are recorded: aq. $Na_2WO_4,2H_2O$, 931 (sharp and intense), 833 (diffuse and possibly multiple), 324 cm.$^{-1}$; cryst. $Na_2WO_4,2H_2O$, 935 (very sharp and intense), 839, 882 (weak and probably multiple), 334 cm.$^{-1}$; cryst. $SrWO_4$, 924, 856, 839, 334 cm.$^{-1}$ The lines are attributed to WO_4'', which has a deformed tetrahedral structure; they are more diffuse in aq. solution owing to the deforming effect of hydration. A. J. E. W.

Werner complexes. Raman spectra of tetra- and hexa-co-ordinated complexes. II. Ammines. General discussion. J. P. Mathieu (J. Chim. phys., 1939, **36**, 308—325).—Fresh data on Pt and Rh ammine complexes are presented (cf. A., 1940, I, 57). Material recorded in this and previous papers is discussed from the point of view of the no. and state of polarisation of normal vibrations according to different stereochemical hypotheses. The observed frequencies may be approx. divided into those due to linking of co-ordinated groups to the central atom, and those due to the groups themselves, which latter frequencies may in some cases be suppressed or altered by co-ordination. F. L. U.

What does the Raman effect contribute to the determination of constitution? K. W. F. Kohlrausch (Österr. Chem.-Ztg., 1939, **42**, 345—350).—A review. The method of determination of vibration frequencies from Raman spectra is described and the interpretation of the frequencies in certain cases is discussed with particular reference to the effects of mol. configuration, geometrical isomerism, and the characteristic frequencies of certain groups. J. W. S.

Raman and infra-red spectra of *cyclo*propane. B. D. Saksena (Proc. Indian Acad. Sci., 1939, **10**, **A**, 449—467).—Using the Raman data of Ananthakrishnan (A., 1936, 1180) and the infra-red data of Linnett (A., 1939, I, 8) the structure of *cyclo*propane is discussed. It belongs to the symmetry class D_{3h}; spectroscopic characteristics of the mol. are analysed, and modes of vibration and a potential energy function for the calculation of νν are given. Whilst retaining the same symmetry classification the mol. may have C and H atoms in the same (*a*) or different (*b*) planes. Calc. vals. of νν for (*b*) are in fair agreement with observed, whereas for (*a*) important discrepancies are found. W. R. A.

Raman effect and problems of constitution. XIV. Methyl vinyl ketone. K. W. F. Kohlrausch (Ber., 1939, **72**, [*B*], 2054—2057).—Comparison is made of the Raman spectra of the systems COMeX (field *A*) and CH_2:CH·COX (field *B*) in which X = OH, Me, Cl, or H. In support of the constitution CH_2:CH·COX the *B* spectra show the frequencies characteristic of the group CH_2:CH. It is possible to perform in field *B* transitions which are precisely similar to those which in field *A* are regarded as characteristic of the group C·COX. Also the CO frequency ~1700 shows the same progress as in field *A* as well as the diminution of frequency and strengthening of intensity typical of the conjugation C:C·C:O. Observation of the spectrum of COMe·CH:CH_2 in course of polymerisation shows that there is no alteration in the intensity relationships of the C:C and C:O frequency in the first stage of polymerisation, *i.e.*, during the transition from mobile to viscous liquid or jelly. Polymerisation is therefore not accompanied by rupture of the C:C linking. The sole obvious change in the aged materials is a diminution in the intensity of the CH vibrations 3026 and 3099 proper to CH_2:CH; the observation requires further confirmation. H. W.

Raman and infra-red spectra and the molecular constitution of pyrrole, thiophen, and furan. G. B. Bonino (Atti X Congr. Internaz.

Chim., 1938, II, 141—157).—The literature of the subject is discussed. It is considered that the mol. symmetry of the above-mentioned mols. is uncertain.
O. J. W.

Absorption spectrum of single-crystal ZnS phosphors. C. J. BRASEFIELD (Physical Rev., 1940, [ii], **57**, 162).—Absorption curves for ZnS single crystals made by firing in a vac. pptd. ZnS with ~0·004% Cu show that absorption is partial for λλ <4250 A. and complete for λλ <3650 A.
N. M. B.

Luminescent materials. I. Theory of the zinc sulphide–copper crystal phosphor. Y. UEHARA (Bull. Chem. Soc. Japan, 1939, **14**, 539—546).—A quantum-mechanical explanation of the fluorescence and phosphorescence is offered in terms of the zone theory. The active centre of the ZnS–Cu phosphor is the $Cu^{\cdot}$ ion surrounded by Zn and S. Transition of the electron of this ion from the $^1S_0$ ground state to the conduction band causes the fluorescence excitation bands. The two fluorescence bands at 5250 and 4550 A. in this phosphor are due to the electronic transitions $^3D_3 \rightarrow {}^1S_0$ and $^3D_2 \rightarrow {}^1S_0$ respectively. The absorption of heat energy by the electron in the excited states of the $Cu^{\cdot}$ ion causes transition to the conduction band and photo-conductivity results.
T. H. G.

Band spectra of cathodo-luminescence. S. T. HENDERSON (Proc. Roy. Soc., 1939, **A**, **173**, 323—338).—The investigation deals with a no. of fluorescent materials excited by electronic bombardment. Bands in ZnS and ZnS–CdS have an intensity distribution which is closely represented by a Gaussian error curve. The activator metal produces a band in a characteristic position independent of the amount of activator present. The effects of temp. and of ultra-violet excitation are also studied. A simple relation is found to exist between the position of a band and the composition of the ZnS–CdS series of phosphors, and the electronic transitions responsible are discussed.
G. D. P.

Fluorescence of sodium formate in sodium hydroxide solution. A. GRUMBACH and R. MILLET (Compt. rend., 1940, **210**, 49—50; cf. A., 1934, 239).—The intensity of the blue fluorescence of aq. NaOH containing 0·072—0·72 g. of HCO_2Na is measured; a max. occurs with 0·36 g. of HCO_2Na. The fluorescence band has a max. at ~4600 A. (exciting light, 3550 A.).
A. J. E. W.

Propagation of electron waves in ionic single crystals. A. VON HIPPEL and J. W. DAVISSON (Physical Rev., 1940, [ii], **57**, 156—157).—The direction effect, or dependence of breakdown direction on crystallographic orientation, is expected to be associated with a magnitude effect relating breakdown field strength with orientation. Attempts to detect this magnitude effect using NaCl prepared by a special method to secure faultless samples for every crystallographic direction gave negative results at room temp. In every direction tested the breakdown strength was 1·65±5% Me.v. per cm. This result disproves the wave-mechanical breakdown theory described and raises difficulties in the ionisation theory.
N. M. B.

Total secondary electron emission from polycrystalline nickel, sodium chloride, and potassium chloride. H. SAEGUSA and T. MATSUMOTO (Sci. Rep. Tôhoku, 1939, **28**, 245—260).—The secondary electron emission of polycryst. Ni and of sublimed films of NaCl and KCl has been measured from 0 to 40 v. Positions of max. emission for Ni agree with vals. of Rao (A., 1930, 1080). A max. emission for KCl was observed at 8 v., close to the max. of light absorption at 7·43 v. Na shows max. emissions at 14 and 23 v.
O. D. S.

Space-charge and lattice-layer theories of the crystal rectifier. W. SCHOTTKY and E. SPENKE (Wiss. Veröff. Siemens-Werken, 1939, **18**, Part 3, 1—67).

Contact difference of potential between barium and zinc. External work function of zinc. P. A. ANDERSON (Physical Rev., 1940, [ii], **57**, 122—127).—Methods previously reported (cf. A., 1939, I, 9) are extended to Zn with reference to Ba. Measurement was by the retarding potential method with variable anode, in tubes sealed from the pumps and gettered with vaporised Ba. In observations on 3 tubes and 15 pairs of Ba–Zn surfaces the observed contact p.d., mean val. 1·76 v., was reproducible and const. to ±0·02 v. Combination of this val. with the Ba work function 2·52 e.v. gives 4·28± 0·02 e.v. for the work function of Zn at room temp. Evidence is given to show that the work function measured under optimum vac. conditions is characteristic of clean Zn, and not of a gas-contaminated surface in equilibrium with the residual gas.
N. M. B.

Photopotential of the element, metal–semi-conductor–metal. VI. Normal photopotential of the inner photo-electric effect. G. MÖNCH (Ann. Physik, 1939, [v], **36**, 557—566; cf. A., 1940, I, 97).—Theoretical. Semi-conductors with photopotential of the same sign as the thermo-electric potential are classified as showing "normal" photopotential. A relation for the normal photopotential is deduced by analogy with that for the thermo-potential and on the assumption that the effect of light absorption on the electronic state of the semi-conductor is equiv. to a rise in temp.
O. D. S.

Variation in the electrical conductivity of some hydrous crystals with temperature. H. SAEGUSA and T. MATSUMOTO (Sci. Rep. Tôhoku, 1939, **28**, 235—244).—The variation in the electrical conductivity, σ, of single crystals of $CuSO_4,5H_2O$, $CaSO_4,2H_2O$, $FeSO_4,7H_2O$, $KCr(SO_4)_2,12H_2O$ (I), and $K_4Fe(CN)_6,2H_2O$ with increasing temp. has been measured and compared with that of the same crystals after complete dehydration. σ of the hydrous crystals increases with temp. but decreases anomalously at the dehydration temp. σ of the dehydrated crystals obeys $\log \sigma = B + A/T$ and is in all cases < σ of the hydrates. The dehydrated crystal of (I) obeys this relation approx. at temp. >150° but is almost const. at 30—150°.
O. D. S.

Dielectric constant near the m.p. R. GUILLIEN (J. Phys. Radium, 1940, [viii], **1**, 29—33).—A detailed account of work already noted (cf. A., 1938, I, 297, 497).
W. R. A.

Torsional flexibility of aliphatic chain molecules. A. Müller (Proc. Roy. Soc., 1940, **A**, **174**, 137—144).—The variation with temp. of the dielectric polarisation of the diketones $COEt\cdot[CH_2]_4\cdot COEt$ (I) and $COEt\cdot[CH_2]_5\cdot COEt$ (II) shows that in the neighbourhood of their m.p. even comparatively short chains suffer considerable distortion under the influence of temp. Both (I) and (II) have two dipoles but in (I) they point in opposite directions while in (II) they point in the same direction. (I) should be electrically neutral at any temp. if the chain is rigid since the two dipoles compensate one another, and there should be no increase of polarisation at the m.p. (II) should behave in a different way, showing strong dipole effects. Lack of rigidity of the chain between the dipoles would result in both substances showing an increase of polarisation at the m.p., the effect which is observed. G. D. P.

Electric moments of heterocyclic compounds with condensed nuclei. M. Milone and G. Tappi (Atti X Congr. Internaz. Chim., 1938, II, 352—357; cf. A., 1935, 684).—The dipole moments in dioxan solution of the dioximes of *o*-benzoquinone and some of its Me derivatives, *p*-benzoquinone, and β-naphthaquinone, and of the peroxides and furazans of these dioximes have been measured. The peroxides have a high μ, > that of the furazans. The μ of mols. having axial symmetry is < that of mols. with no axial symmetry. The structure of the $C_2N_2O_2$ ring is discussed. O. J. W.

Effect of quasi-crystalline structure on molecular rotation and relaxation in dipole liquids. E. Fischer and G. Klages (Physikal. Z., 1939, **40**, 721—727).—Dispersion measurements with $COMe_2$, PhCl, $PhNO_2$, o-$C_6H_4Cl_2$, octyl, decyl, lauryl, and cetyl chloride in the pure state and in dil. C_6H_6 solution have been carried out in the λ range 150—10 cm. The relaxation times have been determined. The behaviour of liquids with normal dipole interaction (approx. spherical mols.) can generally be adequately described by the Debye conception of a rotation hindrance potential. The alcohols do not behave in this manner, owing to the interaction of the free polar OH groups. Liquids with long-chain mols. (alkyl chlorides) show a strong displacement of the dispersion range towards the shorter λλ, which can be explained by the development of a quasi-cryst. ordered state by a predominating parallelism of the long mols. A. J. M.

Zwitter-ion structures in unsaturated carbonyl compounds. A. Weizmann (Trans. Faraday Soc., 1940, **36**, 329—333).—The following dipole moments (in C_6H_6 or dioxan) are recorded: p-$NMe_2\cdot C_6H_4\cdot CHO$, 5·6 D.; p-$NMe_2\cdot C_6H_4\cdot CH\colon CH\cdot CHO$, 5·4 D.; p-$NMe_2\cdot C_6H_4\cdot CH\colon CH\cdot COMe$, 5·3 D.; p-$NMe_2\cdot C_6H_4\cdot CH\colon CH\cdot COPh$, 4·3 D.; p-$NH_2\cdot C_6H_4\cdot CO_2Et$, 4·0 D.; p-$NMe_2\cdot C_6H_4\cdot CH\colon CH\cdot CO_2Et$, 4·6 D.; m-$NH_2\cdot C_6H_4\cdot COMe$, 5·4 D. In addition δ-p-*dimethylaminophenyl*-$\Delta^{\alpha\gamma}$-*butadienyl Me ketone* (I), two geometrical isomerides, m.p. 120° and 215°, have μ = 6·7 and 2·4 D. respectively, and *Ph* δ-p-*dimethylaminophenyl*-$\Delta^{\alpha\gamma}$-*butadienyl ketone*, m.p. 155—157°, has μ = 5·4 D. The large moments indicate zwitter-ion structures, and the lower val. for the higher-melting isomeride of (I) indicates a *cis*-position of the polar groups. F. J. G.

Internal field and time of relaxation. S. Sosinski (Acta Physicochim. U.R.S.S., 1939, **11**, 767—782).—A modified Lorentz relation, $F = E + \frac{4}{3}\pi(1 - \nu)I$, where ν/ρ is a linear function of T, leads to good agreement between observation and theory for low-frequency polarisation phenomena in alcohols but not in H_2O, $COMe_2$, or PhCl. F. J. G.

Polar structure of some benzein indicators. M. A. Elliott and S. F. Acree (J. Res. Nat. Bur. Stand., 1939, **23**, 675—681).—The electric moments of α-naphthol- and thymol-benzein, calc. from their dielectric consts. measured at 25° in C_6H_6 solution with a resonance apparatus (described), are 4·3 and 6·8 D. respectively. These vals. are < those predicted for the static dipolar structures of the benzein mol. type, but are compatible with the quinone–phenolate resonance theory, in which the mols. are predominantly in the least polar form. W. R. A.

Physical properties and chemical constitution. V. Alkyl ketones. D. M. Cowan, G. H. Jeffery, and A. I. Vogel (J.C.S., 1940, 171—176).—n for the C, D, F, and G' lines at 20° and the surface tension and d at various temp. of the following ketones have been determined: $COMe_2$, COMeEt, $COEt_2$, $COMePr^\alpha$, $COEtPr^\alpha$, $COPr^\alpha_2$, $COMeBu^\alpha$, $COMeBu^\beta$, $COMe\cdot C_5H_{11}$-n, $COMe\cdot C_6H_{13}$-n, and $COBu^\beta_2$. The mol. refractivities and parachors are calc. The method of prep. of $COEt_2$, $COMePr^\alpha$, $COEtPr^\alpha$, and $COPr^\alpha_2$ by passing the appropriate acid vapours over heated MnO (400°) as a catalyst is described. A. J. M.

Anisotropy of cellulose sheet. D. G. Drummond (Nature, 1940, **145**, 67).—The data recorded for the birefringence of Cellophane sheets are consistent with the results obtained (A., 1940, I, 14) with sheets of cellulose acetylated to different extents. Certain differences are ascribed to the absence of acyl side-chains in the regenerated cellulose. L. S. T.

Models of the molecular structure of liquids. W. Kast and H. A. Stuart (Physikal. Z., 1939, **40**, 714—718).—Models made up of particles to represent the mols. of liquids, which can be shaken so as to find the positions taken up by mols. in a liquid, are described. Results for the rotational hindrance for spherical mols. (Hg, HCl, CCl_4) and rod-like mols. (CS_2, HCN) for various packing densities are described. A. J. M.

Constitution of thiocyanic acid. F. Gallais and D. Voigt (Compt. rend., 1940, **210**, 104—106; cf. A., 1939, I, 401).—Vals. of the mol. magnetic rotatory power of aq. HCNS at 20° are 177, 204, and 343 × 10^{-2} min. at 5780, 5460, and 4360 A., respectively; these vals. show that HCNS exists in the *iso*-form in aq. solution. There is no equilibrium between the two forms as the rotation does not vary with concn. (59—193 g.-mol. per l.). Isomerisation due to heating during prep. is not detected. A. J. E. W.

Resonance and the chemistry of histidine. T. L. Hill and G. E. K. Branch (Science, 1940, **91**,

145—146).—The 15 principal resonance forms of histidine (I) are classified into 4 groups, each containing structures with similar energies, and can be used to explain certain chemical characteristics of (I). L. S. T.

Constitution of bile acids.—See A., 1940, II, 130.

Spherical molecules. H. J. BACKER (Chem. Weekblad, 1940, **37**, 79—83).—A review of the properties of compounds having spherical and rod-like configurations. S. C.

Theory of complex compounds. A. GELMAN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 549—552).—The structure of C_2H_4, CO, and NO co-ordinated compounds of Pt is discussed. O. D. S.

Relationship between the electron-sharing ability of radicals and the association of organic compounds. F. A. LANDEE (Iowa State Coll. J. Sci., 1939, **14**, 55—56).—It was predicted, from theoretical considerations involving the fact that H attached to O is the controlling element in both mol. dissociation and association, that the entry of radicals of high positive electron-sharing ability into an associating compound should cause a decrease in the mol. complexity of the compound. By v.d. measurements the effect was shown experimentally for RCO_2H-type carboxylic acids. Measurements on the v.p. of solutions showed a similar but small effect for the same series of acids in solvents such as $COMe_2$, Et_2O, and MeOAc. A study of theories of solvent influence on solute association indicates that the older theory that regards the dielectric const. as the controlling factor is invalid, and that the real factor is the reaction of the solvent in solvating the solute. This was verified by a derivation of the solvating order of a series of solvents of the type PhR. It is concluded that the entry of radicals of high electron-sharing ability into a solvating compound should cut down the extent of the solvation reaction and that this would be reflected by the increase of the associating power of this compound as a solvent. N. M. B.

Extended co-ordination theory of valency. IV. Configuration of compounds of transition elements. R. TSUCHIDA, M. KOBAYASHI, and H. KUROYA (Rev. Phys. Chem. Japan, 1939, **13**, 151—165).—Continuing the extension of Werner's co-ordination theory (cf. A., 1939, I, 357, 358, 599), the configuration of compounds of transition elements is dealt with. The zero-order eigenfunctions for the formation of compounds of various co-ordination nos. are given, and the method of finding the configuration of compounds is described. It is shown that the octahedral bond is the strongest of the co-ordination bonds. Not only the configuration of an ion or mol., but also the electronic distribution and magnetic moment, can be predicted solely from the composition. C. R. H.

Calculation of eigenfunction and energy of ground state of valency electron in alkali atoms. P. GOMBÁS (Ann. Physik, 1939, [v], **36**, 680).—A correction (cf. A., 1939, I, 352).

Systematics of band-spectral constants. V. Interrelation of dissociation energy and equilibrium internuclear distance of di-atoms in ground states. C. H. D. CLARK (Trans. Faraday Soc., 1940, **36**, 370—376).—The relationship $Dr_e^3n^{\frac{1}{2}} =$ const. for non-hydride di-atoms (cf. A., 1939, I, 598) is tested, and an analogous equation $Dr_e^4n =$ const. is suggested for hydride di-atoms. F. J. G.

Magnetic energy constants of dipolar lattices. J. A. SAUER (Physical Rev., 1940, [ii], **57**, 142—146).—Mathematical. A calculation of the magnetic energy, assuming dipole–dipole interaction, of a macroscopic crystal having paramagnetic ions on a definite lattice, with consideration of parallel and antiparallel configurations, various types of lattice, and specimens of different shapes. The configuration of lowest energy cannot be strictly defined but depends on the shape of the specimen, and changes, from antiparallel for a sphere to parallel for a long slender specimen, at a crit. val. of the demagnetisation factor. Implications of the theory are discussed. N. M. B.

Bose–Einstein fluids. L. GOLDSTEIN (Physical Rev., 1940, [ii], **57**, 241—242, 457).—Mathematical. In view of London's suggestion (cf. A., 1939, I, 56) that the two liquid modifications of He, above and below the transition temp., might correspond with the phases predicted for an ideal Bose–Einstein fluid, the elasticity properties of such a fluid with reference to light scattering are examined. N. M. B.

Energy states of the valency electrons in some metals. I (11). Nature of the anomalies of zinc and its electronic structure. M. SATÔ (Sci. Rep. Tôhoku, 1939, **28**, 143—196; cf. A., 1939, I, 246).—The anomalous temp. of Zn correspond with transitions between adjacent components of the fine structure of a crystal level. The energy states of the valency electrons associating to levels E_1, E_2, and E_3 are: $(4s, 4p)(4s, 5p)^5D_{4,3,2,1,0}$, $(4s, 4p)(4s, 4d)^5F_{5,4,3,2,1}$, and $(4s, 5p)(4s, 9p)^3P_{1,2,3}$ respectively, and those of E_4 are probably $(4s, 5p)(4s, 22d)$, with the transition at 0·79° K. from super- to non-super-conductivity corresponding with the transition from the lowest to the next component of E_4. The modes of combination between the levels E_1, E_2, E_3, and E_4 previously deduced (A., 1937, I, 414) are confirmed. From consideration of the sp. heat, heat of vaporisation, surface tension, and heat of fusion of liquid Zn it is deduced that, from m.p. to 905°, Zn atoms are bound in groups of four, 50% permanently bound by resonance $E_1 \rightleftharpoons E_4$, and 50% temporarily bound, with alternate dissociation and association, by resonance $E_2 \rightleftharpoons E_3$, and that at the transition temp. 905° the $E_1 \rightleftharpoons E_4$ association becomes temporary. O. D. S.

Physical properties of aliphatic acid anhydrides. D. T. LEWIS (J.C.S., 1940, 32—36).—The γ, ρ_4, and η of acetic, propionic, butyric, and hexoic anhydrides have been measured at 5° intervals from 15° to 50°. The mean parachor vals. agree well with those computed on the basis of a typical ester anomaly, the other parts of the mol. making a normal parachor contribution. The parachor vals. increase by 0·3% with temp. over the range studied.

η increases regularly as the series is ascended. The method of Rosenbaum and Walton (A., 1930, 1270) for determining the anhydrides was found to be satisfactory for Ac_2O only. W. R. A.

Chemical war materials. XV. Parachors of ββ′-dichlorodiethyl sulphide, β-chlorodiethyl sulphide, diethyl sulphide, and thioglycol. Simple apparatus for determining surface tension. W. MOHLER and J. SORGE (Helv. Chim. Acta, 1940, **23**, 119—124).—The observed parachor of $(Cl·[CH_2]_2)_2S$ is ~6 units > the calc. val. The significance of this difference is discussed and compared with the similar val. which, according to Sugden, has to be added to the atom const. when a compound contains a 6-membered-ring. The observed parachors of the other three compounds are only 1—2 units > the calc. vals. A surface tension apparatus is described. C. R. H.

Molecular polarisation and the capillary constant. P. BOGDAN (Atti X Congr. Internaz. Chim., 1938, II, 132—140; cf. A., 1935, 285).—The expression $\gamma V^{5/3} = 6·62P(\theta - T)$ is derived, where γ = capillary const. at the abs. temp. T, V = mol. vol. of liquid, θ = abs. crit. temp., P = real vol. of mols. contained in V, *i.e.*, the deformation polarisation. Vals. of P are calc. for several liquids. P varies with T, but P/T is fairly const. over a large temp. interval. Some other consequences of the theory are discussed. O. J. W.

Effect of quartz filters on the distribution of energy in Laue patterns. D. W. STEBBINS (Iowa State Coll. J. Sci., 1939, **14**, 84—86; cf. Fox, A., 1935, 1059).—Using a double-crystal arrangement with a collimator between the two crystals, an attempt to determine whether a crystal extracts all the energy of a given λ gave inconclusive results. Oscillation of a crystal does not change the intensity of the central beam but it does alter its composition. N. M. B.

Sphere of transference of the action of forces in a real crystal system. D. BALAREV (Atti X Congr. Internaz. Chim., 1938, II, 103—110; cf. A., 1938, I, 389).—A further discussion of the author's views on the non-homogeneity of crystals. O. J. W.

Theory of crystal growth and the possibility of determining the forces acting between the lattice components in homopolar crystals by means of crystal growth shapes. I. N. STRANSKI (Atti X Congr. Internaz. Chim., 1938, II, 514—525; cf. A., 1937, I, 447).—A summary of recent knowledge on crystal growth. O. J. W.

Crystal habit variation in sodium fluoride. C. FRONDEL (Amer. Min., 1939, **24**, 185).—The effect of foreign materials (~250 inorg. and org. solutes, including 120 dyes) on the habit of growing crystals of NaF, and other NaCl-type alkali halides, has been determined. Inorg. solutes which yield OH′ directly or by hydrolysis, and certain org. solutes containing OH, cause an octahedral habit by substitutional adsorption of OH′ for F′. Solutes that form compounds with NaF cause variation in habit, but not by substitutional adsorption. Few dyes are effective, and any action is sp. for different halides; the arrangement of polar OH′ or SO_3H' in the dye influences the adsorption. L. S. T.

Crystal space-groups determined without X-rays. J. D. H. DONNAY (Amer. Min., 1939, **24**, 184).—A method is outlined. L. S. T.

Chalcogenides of vanadium and their relations to the chalcogenides of the other transition elements. W. KLEMM (Atti X Congr. Internaz. Chim., 1938, II, 696—705).—Crystal structure and magnetic properties of V selenides are discussed (see A., 1939, I, 484). O. J. W.

Probable structure of polonium oxide in relation to that of metallic polonium. M. A. ROLLIER (Atti X Congr. Internaz. Chim., 1938, II, 770—774).—Evidence is given that the crystal structure data previously obtained (cf. A., 1937, I, 18) really refer to metallic Po and not to an oxide. O. J. W.

Fibrous structure of alkali metals. C. GORIA (Atti X Congr. Internaz. Chim., 1938, II, 644—656; cf. A., 1936, 559).—X-Ray investigations of alkali metals and a solid K–Rb alloy subjected to certain thermal and mechanical treatment confirm the fibrous structure of these metals. O. J. W.

Crystal structure of phosphorus pentachloride. H. M. POWELL, D. CLARK, and A. F. WELLS (Nature, 1940, **145**, 149).—X-Ray diffraction shows that PCl_5 is tetragonal, with a_0 9·2, c_0 7·4 A., ρ ~2·0 g. per c.c., 4 mols. per unit cell; space-group $P4/n$. The ionic structure contains tetrahedral $[PCl_4]^+$ and octahedral $[PCl_6]^-$ groups. L. S. T.

Vanadium silicide, V_3Si. H. J. WALLBAUM (Z. Metallk., 1939, **31**, 362).—V_3Si has a cubic lattice a 4·712 A., 2 mols. per unit cell. The Si atoms occupy the (0 0 0) and ($\frac{1}{2}\,\frac{1}{2}\,\frac{1}{2}$) positions and the V atoms the ($\frac{1}{4}\,0\,\frac{1}{2}$), ($\frac{1}{2}\,\frac{1}{4}\,0$), ($0\,\frac{1}{2}\,\frac{1}{4}$), ($\frac{3}{4}\,0\,\frac{1}{2}$), ($\frac{1}{2}\,\frac{3}{4}\,0$), ($0\,\frac{1}{2}\,\frac{3}{4}$) positions. V_3Si is therefore isomorphous with Cr_3Si. A. R. P.

Polymorphism and isomorphism of the sulphides and selenides of nickel, cobalt, cadmium, and mercury. A. BARONI (Atti X Congr. Internaz. Chim., 1938, II, 586—592; cf. A., 1938, I, 501).—Electron diffraction measurements show that CoS and CoSe have, in addition to the hexagonal β form of the magnetic pyrites type, a rhombohedral γ form of the millerite type and an amorphous α form which tends to become cryst. These various modifications form mixed crystals in all proportions with the corresponding modifications of NiS and NiSe. HgSe has in addition to the form of the Zn blende type an unstable hexagonal modification analogous to HgS. The Zn blende modifications of CdS and CdSe and of HgS and HgSe can form mixed crystals in all proportions. O. J. W.

Crystal structure of potassium sulphamate. C. J. BROWN and E. G. COX (J.C.S., 1940, 1—10).—$NH_2·SO_3K$ has a 8·32, b 8·28, c 5·90 A., ρ 2·23, 4 mols. per unit cell, space-group $Pbma(D_{2h}'')$. It has an ionic structure and contains no H bridges between neighbouring anions. The $NH_2·SO_3'$ group is an almost regular tetrahedron around S with S—O = 1·44±0·03, S—N = 1·57±0·03 A. Although not directly determinable, there is strong evidence to

indicate that H atoms are attached to N and not to O. $NH_2 \cdot SO_3H$ has *a* 8·06, *b* 8·05, *c* 9·22 A., ρ 2·12, 8 mols. per unit cell, space-group *Pcab* (D_{2h}^{15}). W. R. A.

Structure and thermal properties associated with some hydrogen bonds in crystals. III. Further examples of the isotope effect. A. R. Ubbelohde (Proc. Roy. Soc., 1939, A, **173**, 417—427; cf. A., 1939, I, 306).—The effect of substitution of D for H on the lattice spacing of pentaerythritol, $CuSO_4,5H_2O$, $SrCl_2,6H_2O$, furmaric acid, KH_2PO_4, $NaHSO_4$, $CO(NH_2)_2$, and KHF_2 has been studied. If the crystal structure contains OH bonds the isotope effect is small, but with H bonds there is a marked expansion, which in the case of KH_2PO_4 leads to a new crystal structure. G. D. P.

***X*-Ray analysis of complex salts of glyoximes with bivalent nickel.** M. Milone (Atti X Congr. Internaz. Chim., 1938, II, 346—352).—Ni salts of the following alkylglyoximes have been crystallised from $PhNO_2$: OH·N:CH·CMe:N·OH, $(CMe:N \cdot OH)_2$ (I), and OH·N:CMe·CEt:N·OH (II). *X*-Ray measurements show that (I) and (II) are rhombic with 2 mols. per unit cell: (I) *a* 9·5, *b* 13·6, *c* 5·7 A., *V* 736 c.c., $d_{calc.}$ 1·3, $d_{obs.}$ 1·46, space-group D_2^6; (II) *a* 11·62, *b* 11·9, *c* 4·6 A., *V* 636 c.c., $d_{calc.}$ 1·64, $d_{obs.}$ 1·73, space-group D_2^3. The structure of these salts is discussed. O. J. W.

***X*-Ray study of the phthalocyanines. IV. Direct quantitative analysis of the platinum compound.** J. M. Robertson and (Miss) I. Woodward (J.C.S., 1940, 36—48).—The possibilities and difficulties of the method of substituting an atom of high at. no. in a complex org. compound in order to obtain quant. *X*-ray structural data are discussed. The method is tested for Pt phthalocyanine, $C_{32}H_{16}N_8Pt$, which has *a* 23·9, *b* 3·81, *c* 16·9 A., β 129·6°, ρ 1·98, *F* (000) 684, two centrosymmetrical mols. per unit cell of vol. 1186 $A.^3$, space-group C_{2h}^5 ($P2_1/a$). The positions of all atoms, except H, have been determined to ±0·05 A. The mol. structure is closely similar to that of the other phthalocyanines investigated (A., 1937, I, 172; 1936, 1186) although dimensions are slightly different. The crystal structure is different, however, since the mols. are arranged differently and their planes are inclined at 26·5° instead of 44·2° to the (010) plane. W. R. A.

Polymorphism of choline ester iodides. (Mlle.) C. Stora (Compt. rend. 1940, **210**, 107—109).—Crystallographic data for the *A* and *B* forms of lauryl- (I) and palmityl- (II) and the *B* form of stearyl-choline iodides (III) are discussed (cf. A., 1940, II, 37). The *A* forms are weakly birefringent and monoclinic, with symmetry C_{2h}^1—P_{2m}; the choline chains lie approx. parallel to the *c* axis. The *A* form of (I) exists in two varieties. The *B* forms are strongly birefringent and triclinic; that of (I) reverts rapidly to the *A* form, but the change is slower with (III) and undetectable with (II). Cell dimensions and *d* and *n* vals. are given. Oriented layers are obtained by evaporation of a C_6H_6 or EtOH solution of the ester iodide on glass. A. J. E. W.

***X*-Ray researches on aspergillin.** A. Quilico and M. A. Rollier (Atti X Congr. Internaz. Chim., 1938, II, 446—451).—*X*-Ray investigation of the brownish-black pigment of *Aspergillus niger* by the Debye–Scherrer method reveals two well-defined characteristic lengths of 2·14 and 3·55 A. and a more doubtful one of 4·7—4·9 A. Comparison with data for humic acid shows that its structure is similar to that of aspergillin (I). The C skeleton of the (I) mol. is very stable towards heat and is unchanged by heating in H_2 for 1 hr. at temp. up to 700°. O. J. W.

***X*-Ray study of aspergillin.** A. Quilico and M. A. Rollier (Atti X Congr. Internaz. Chim., 1938, III, 346—347).—Debye–Scherrer patterns from aspergillin (I) are ill-defined, but show distances of 3·40 and 2·11 A., corresponding with two of the three found with humic acid, the structural relation of (I) to which is thus confirmed. Patterns from (I) heated with H_2 at 300—700° show little change; only at high temp. do some of the graphite rings appear. The distance 3·40 A. (above) corresponds with the (002) plane of graphite. E. W. W.

Unit cell and space-group of β-octamethylcellotriose and β-hendecamethylcellotriose. T. Ohasi (Bull. Chem. Soc. Japan, 1939, **14**, 517—520).—Both crystallise in the space-group $P2_12_12_1$, the former having *a* 12·0, *b* 43·7, *c* 4·50 A. and the latter *a* 21·3, *b* 34·5, *c* 4·50 A. These results differ markedly from those of Trogus and Hess (A., 1935, 1308). T. H. G.

Diffraction of convergent electron beams. C. H. MacGillavry (Nature, 1940, **145**, 189—190; cf. A., 1940, I, 101).—The fine structure of diffraction spots obtained from mica with convergent electron beams is explained on the basis of the dynamical diffraction theory. Structure factors can be determined by measuring distances between min. in the fine structure of a diffraction spot without using intensity measurements. L. S. T.

Molecular structure of nitrosyl chloride. J. A. A. Ketelaar (Atti X Congr. Internaz. Chim., 1938, II, 301—308).—Electron diffraction measurements with gaseous NOCl and NOBr show that these mols. are non-linear, with an angle of 116° between the N–O and N–halogen linkings. The following interat. distances were obtained: Cl—N 1·94±0·02, Cl—O 2·64±0·02, N—O 1·14±0·04, Br—N 2·14±0·02, Br—O 2·85±0·02 A. Evidence for the occurrence of resonance between the two structures Cl–N=O and Cl^-–N≡O^+ is given. O. J. W.

Electron diffraction of the hydrates of some tervalent metals. M. Baccaredda and E. Beati (Atti X Congr. Internaz. Chim., 1938, II, 99—102).—The electron diffraction by thin films of $Al(OH)_3$, $Cr(OH)_3$, and $Fe(OH)_3$, freshly prepared by the action of gaseous NH_3 on the surfaces of solutions of the corresponding chlorides, has been studied. $Al(OH)_3$ gives interference lines corresponding with the most intense *X*-ray lines of bayerite, and the lines due to $Cr(OH)_3$ can be attributed to a hydrate isomorphous with $Al(OH)_3$ and probably with bayerite. $Fe(OH)_3$ gave no interference lines. O. J. W.

Statistical domain theory of ferromagnetic crystals. I. Magnetisation and magnetostric-

tion. II. Mutual action of magnetism and mechanical force. M. TAKAGI (Sci. Rep. Tôhoku, 1939, **28**, 20—84, 85—127).—Mathematical. O. D. S.

Outer initial permeability of Ni for 10—70 M-cycles. J. B. HOAG and J. L. GLATHART (Physical Rev., 1940, [ii], **57**, 240).—A method of determination based on balancing the rate of heat production in a wire heated by high-frequency current against that produced in a similar wire by d.c. is described. Data for Ni are given. N. M. B.

Magnetic viscosity of single crystals of iron. T. NISHINA (Sci. Rep. Tôhoku, 1939, **28**, 217—224).—The time of attainment of equilibrium in the magnetisation at $-195 \cdot 7°$ of single-crystal rods of Fe with axes close to the [100], [110], and [111] crystal axes respectively has been measured at field strengths from 0·02 to 0·27 Oersted. The time lag decreases with increasing intensity of magnetisation and, for the same intensity of magnetisation, changes with the axial direction of the rods in the order $[110] < [100] < [111]$. It is apparently independent of the diameter of the rod. O. D. S.

Energy changes accompanying magnetisation. L. F. BATES and J. C. WESTON (Nature, 1940, **145**, 188—189).—Measurements by a new method of the temp. changes accompanying the magnetisation of a hard-drawn, unannealed Ni (99·67%) rod under longitudinal tensions of 0—31·2 kg. per sq. mm. are recorded graphically. They provide a proof of Warburg's law, and show that 90° rotations of the Weiss domain vectors are not accompanied by measurable heat changes. L. S. T.

Determination of elastic constants by piezo-electric methods. P. J. HART (Iowa State Coll. J. Sci., 1939, **14**, 46—47).—The six independent adiabatic elastic consts. of quartz were evaluated by frequency measurements of piezo-electrically excited harmonic vibrations of finite plates in a filter circuit in a specially designed apparatus. The adiabatic elastic consts. found are: C_{11} 87·45, C_{12} 6·03, C_{14} 17·8, C_{44} 57·1, C_{13} 14·4, and C_{33} 109·0, all $\times 10^{10}$ dynes per sq. cm. N. M. B.

Variation with temperature of the elastic properties of rock-salt. S. VON THYSSEN-BORNEMISZA (Oel u. Kohle, Petroleum, 1939, **35**, 767).—The velocity of propagation of elastic waves in a specimen of rock-salt, determined in the apparatus previously described (Z. Geophysik, 1939, **15**, 130), fell rapidly as the temp. rose from 20° to 60°, and then more slowly from 60° to 120°; at 120° it began suddenly to rise, at first rapidly and then more slowly, and passed through a max. at ~300°. A. B. M.

α–β transformation of quartz. (SIR) C. V. RAMAN and T. M. K. NEDUNGADI (Nature, 1940, **145**, 147).—The changes in the spectrum of monochromatic light (4358 A. of the Hg arc) scattered in a quartz crystal at temp. from $-192°$ to 530° are reproduced. The behaviour of the 220 cm.$^{-1}$ line indicates that the binding forces which determine the ν of the corresponding mode of vibration of the crystal lattices diminish rapidly with a rise in temp. The increasing excitation of this particular mode of vibration with temp. and the resulting deformations of at. arrangement are inferred to be responsible for the well-known changes in physical properties of the crystal, and for inducing the $\alpha \rightarrow \beta$ transformation. L. S. T.

Smits' theory of complexity and allotropy. J. L. MEYERING (Chem. Weekblad, 1940, **37**, 57—60).—Various interesting cases are discussed. S. C.

Molecular state of inorganic liquids. A. R. MORGAN and S. T. BOWDEN (Trans. Faraday Soc., 1940, **36**, 394—397).—Cryoscopic determination of the mol. wt. of $AsCl_3$, PCl_3, S_2Cl_2, $POCl_3$, $SOCl_2$, and SO_2Cl_2 in C_6H_6 shows that only PCl_3 and $POCl_3$ give slight departures (<10%) from ideal behaviour. Methods of calculating association factors are discussed. F. L. U.

Polybenzyls and derivatives. S. BEZZI and C. MARANGONI (Atti X Congr. Internaz. Chim., 1938, II, 118).—The ratios of the mol. wts. determined from viscosity measurements to the mol. wts. determined cryoscopically and by isothermal distillation are practically equal for the polybenzyls and their Br- and NO_2-derivatives, when the degree of polymerisation is equal for all the substances. O. J. W.

Cellulose acetate. S. BEZZI and U. CROATTO (Atti X Congr. Internaz. Chim., 1938, II, 117).—There is no strict relationship between the mol. wt. of cellulose acetates and their solubility in AcOH, which depends also on other factors. O. J. W.

Resistance measurements on iron wires in the frequency range 10^7 to 3×10^8 Hz. M. J. O. STRUTT and K. S. KNOL (Physica, 1940, **7**, 145—154).—With Fe wires 20—40 μ. in diameter, the ratio of a.c. resistance to d.c. resistance increases linearly with the square root of the frequency up to $\sim 3 \times 10^8$ Hz. at room temp. At $-183°$ deviation from the linear relation is appreciable at frequencies $> 5 \times 10^7$ Hz. L. J. J.

Electrical resistance of single crystals of zinc and cadmium in a magnetic field at low temperatures. B. G. LAZAREV, N. M. NACHIMOVITSCH, and E. A. PARFENOVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 855—858).—The dependence of the resistance of single crystals of hexagonal Zn and Cd on crystal structure and orientation of the axes has been examined in magnetic fields up to 18 kilogauss. Single crystals were rotated in transverse magnetic fields at low temp. and graphs of the angle of rotation against resistance computed. The increase of resistance in a longitudinal magnetic field has been investigated and its dependence on the electron–lattice interaction considered. Theories are advanced. W. R. A.

Magnetism and the structure of matter. K. LONSDALE (Nature, 1940, **145**, 57—59).—A summary of three lectures. L. S. T.

Magnetic susceptibilities of some fluorides. A. A. CHOWDHURY (Current Sci., 1939, **8**, 550).—Using a Gouy balance, the following mass susceptibility ($\times 10^6$) data have been obtained: MgF_2, 0·40 (28°); AlF_3, $-0 \cdot 16$ (29·2°); CdF_2, $-0 \cdot 25$ (29°); CrF_3, 91·20 (32°); FeF_3, 122·00 (32°); CuF_2, 23·00

(32·2°); ZnF_2, −0·37 (26·6°); CoF_3, 10·90 (29°); BiF_3, −0·23 (29·8°); "HgF_2 (oxy)," −0·26 (29°); "HgF_2 (ous)," −0·24 (29°); $KBeF_2$, −0·60 (28·6°).
W. R. A.

Magnetic susceptibility of nickel chloride. H. R. NETTLETON and S. SUGDEN (Proc. Roy. Soc., 1939, **A**, **173**, 313—323).—A precise determination of the magnetic susceptibility of $NiCl_2$ was made by the Gouy method. Full details of the experimental arrangement are given. The mean result obtained from observations on two different solutions is $4436\pm12\times10^{-6}$ at 20° for the molar susceptibility.
G. D. P.

Mechanism of cobalt magnetisation. M. J. SCHIROBOKOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 426—429).—Theoretical. H. J. E.

Magnetic susceptibilities of some cupric salts. J. REEKIE (Proc. Roy. Soc., 1939, **A**, **173**, 367—378).—The mass susceptibility of $CuSO_4,5H_2O$, $CuSO_4,K_2SO_4,6H_2O$, and of $CuSO_4,(NH_4)_2SO_4,6H_2O$ has been determined by the Gouy method at temp. down to 1·6° K. The first salt follows a Weiss law over the whole range, as do the double sulphates down to 14° K.; at lower temp. these obey a simple Curie law. The results are discussed in relation to a theory of paramagnetic crystals. G. D. P.

Magneto-chemical investigation of organic substances. True carbon diradical with para-placed "free valencies."—See A., 1940, II, 122.

Photopolymerisation of anthracene in benzene solution from the magnetic viewpoint. S. S. BHATNAGAR, P. L. KAPUR, and (MISS) G. KAUR (Proc. Indian Acad. Sci., 1939, **10**, **A**, 468—476).—Photopolymerisation of solid anthracene (I) and its solution in C_6H_6 leads to the disappearance of two double linkings (one from each of two mols.) and the formation of a bridged four-membered ring. The constitution correction factor (λ) in the magnetic susceptibility (χ) for this ring has been determined by a magnetic study of the products of this photopolymerisation in C_6H_6 solution. (I) was dissolved in C_6H_6 and exposed to sunlight. The colourless solution turned pale yellow after two days, and then gradually darkened to deep orange-red. The m.p. and χ of the solid which separated from day to day decrease gradually, indicating that besides dianthracene (II) other compounds of low χ were forming. After 7 days the separated solid was brown, but recrystallisation from $COMe_2$ gave buff-coloured needles, identified as anthraquinone. The change of colour is due therefore to the formation of photo-oxidation products, and this has been confirmed by photopolymerising (I) under similar conditions in a vac. The product was colourless. Only (II) is formed in a vac. and the yield in a vac. is > that in air. After separation of (II), the fluorescent solution from the vac. was exposed to light in the presence of air. A brown solid (III), $C_{14}H_{10}O_4$, m.p. 180°, $\chi = -0{\cdot}212\times10^{-6}$, separated and the solution, which turned red, liberates I from KI in presence of AcOH, indicating anthracene peroxide (IV). (III) may be formed from (IV), which isomerises to anthraquinol and this is oxidised. The mol. χ of pure (II) and pure (I) are $-237{\cdot}80\times10^{-6}$ and $-129{\cdot}7\times10^{-6}$, respectively, giving $\chi = +21{\cdot}6\times10^{-6}$. The large fall in diamagnetism accompanying polymerisation is explained by assuming that the radius of the polymol. is decreased, and that the influence of the C_6H_6 rings on the valency angles seems to lead to a concn. of the electronic charge in the rings leading to a smaller effective radius. W. R. A.

Magnetic anisotropy of diphenyldiacetylene. K. LONSDALE (Nature, 1940, **145**, 148—149; cf. A., 1939, I, 458).—Diphenyldiacetylene has χ_1 $-93{\cdot}8\times10^{-6}$ ($\pm0{\cdot}05$), χ_2 $-188{\cdot}0\times10^{-6}$, χ_3 $-109{\cdot}6\times10^{-6}$, ψ −88·5°, giving a mean susceptibility of $-130{\cdot}5\times10^{-6}$ (theory, $-129{\cdot}7\times10^{-6}$). The principal susceptibilities deduced for a single mol. are K_L −109·4, K_M −75·3, K_N $-206{\cdot}7\times10^{-6}$. Comparison with the corresponding vals. for tolane (A., 1939, I, 554) indicates a concn. of electron density normal to the C chain axis. L. S. T.

Absorption of sound in oxygen gas and in carbon dioxide gas containing small quantities of H_2O, D_2O, and Ne. Relaxation times for the vibrational energy. A. VAN ITTERBEEK and P. MARIËNS (Physica, 1940, **7**, 125—130).—Data are recorded for the absorption coeff. of sound of λ ~0·05 cm. in pure CO_2 at 0·25—1·0 atm. and 19—89°, in CO_2 containing ~0·3% Ne, and in CO_2 containing ~0·07% H_2O and D_2O over the same temp. range and ~1 atm. The relaxation time for the D_2O mixtures is ~1·5 times that for the H_2O mixtures, and the ratio is independent of temp. Excitation of CO_2 by Ne is very small. Measurements on O_2 at 50—150° are recorded. L. J. J.

Absorption of supersonic waves in water and in aqueous suspensions. G. K. HARTMANN and A. B. FOCKE (Physical Rev., 1940, [ii], **57**, 221—225).—Absorption in H_2O and in an aq. suspension of lycopodium was measured in the frequency range 990—2500 kc. The differences in the absorption coeffs. for the suspension and for H_2O approach more nearly the theoretical val. as the frequency increases.
N. M. B.

Critical and co-operative phenomena. V. Specific heats of solids and liquids. A. F. DEVONSHIRE (Proc. Roy. Soc., 1940, **A**, **174**, 102—109).—The sp. heats of Kr and A are calc. in terms of the intermol. forces and are in fair agreement with the experimental vals. Thermal expansion and compressibility are also calc. The method is an extension of the ideas developed in the previous papers of the series (cf. A., 1939, I, 248, 358). G. D. P

Thermal capacity of pure iron. J. H. AWBERY and E. GRIFFITHS (Proc. Roy. Soc., 1940, **A**, **174**, 1—15).—The determination was carried out on a specimen of purity >99·99%. The method of experiment is fully described. The results are discussed in three temp. ranges. Between 0° and 300° the sp. heat increases continuously; none of the variations and discontinuities reported by other investigators were found in this temp. range. The Curie point, 755°, is associated with energy changes which affect the sp. heat–temp. curve over a wide range. Above the magnetic point the sp. heat falls rapidly until

900°; the α–γ transformation takes place at 903°, at which temp. the sp. heat becomes infinite. A smaller max. in the sp. heat–temp. curve is found at 908°, after which the curve falls to the val. for γ-Fe. G. D. P.

Specific heat of water and of heavy water. A. H. COCKETT and A. FERGUSON (Phil. Mag., 1940, [vii], **29**, 185—199).—Using the method of Ferguson and Miller (cf. A., 1933, 366), full data measured in the range 15—50° are tabulated. Equations for the temp. variation of sp. heat give min. vals. for the sp. heat at 38° for H_2O and 41° for D_2O; the corresponding sp. heats are 0·9984 and 1·0037, respectively. N. M. B.

Virtual entropy of silicon fluoride calculated from the molecular constants. I. G. RISS (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 568—569).—The entropy of SiF_4 from 25° to 300° is tabulated. $(S_{total})_{25°} = 67{\cdot}439$ g.-cal. per degree per mol. O. D. S.

Heat of fusion of ice. N. S. OSBORNE (J. Res. Nat. Bur. Stand., 1939, **23**, 643—646).—Using more recent data for the heat capacity of H_2O, a revised val. for the heat of fusion of ice is derived as 333·5 international joules per g. W. R. A.

Physical properties of purified $\beta\beta\gamma$-trimethylpentane. D. B. BROOKS, F. L. HOWARD, and H. C. CRAFTON, jun. (J. Res. Nat. Bur. Stand., 1939, **23**, 637—641).—A synthetic specimen of $\beta\beta\gamma$-trimethylpentane (synthesis and purification given) had f.p. —112·37°, m.p. —112·33°, b.p. 109·843°/760 mm., n_D^{20} 1·40285, n_D^{25} 1·400038, ρ^{20} 0·71617, ρ^{25} 0·71218. The variation of b.p. with pressure $dT/dP = 0{\cdot}0480°$ per mm.; $dn/d\theta = -0{\cdot}000494$ per degree; $d\rho/d\theta = -0{\cdot}000797$ g. per c.c. per degree. W. R. A.

Thermal properties of sulphur dioxide. G. SEGER and H. CRAMER (Z. ges. Kälte-Ind., 1939, **46**, 183—185).—A chart summarises data available for sp. vol., sp. heat, v.p., etc. R. B. C.

Evaporation coefficients of polar crystals. K. NEUMANN and V. COSTEANU (Z. physikal. Chem., 1939, **185**, 65—80).—The v.p. of $KReO_4$ has been determined by the Knudsen method at 503—580°. It is given by $\log p_{solid} = 22{\cdot}045 + 16092/T$ and $\log p_{liquid} = 15{\cdot}586 + 11666/T$, and the heats of vaporisation of the solid and liquid, and the heat of fusion, are respectively 73·28, 53·12, and 20·16 kg.-cal. per g.-mol., respectively. From measurements of the rate of evaporation of a small crystal the evaporation coeff. is ~0·8. This val. is surprisingly high, but can be accounted for in terms of a progressive roughening of the surface (experimental evidence for a lower initial rate of evaporation being given), and of migration of ion-pairs over the surface to situations from which evaporation is easy, the activation energies for such migration being shown to be relatively low. F. J. G.

Vapour pressure of oleum. F. D. MILES, H. NIBLOCK, and G. L. WILSON (Trans. Faraday Soc., 1940, **36**, 345—356).—The v.p. of SO_3 at 17—62° and of oleum ($\not>$70% free SO_3) at 20—170° have been determined by a static method and are reproduced by tables and by p–T and p–C curves. The mol. heat of vaporisation for SO_3 is 10,480 g.-cal., but for the oleums it increases with decreasing [SO_3] to a max. at ~30% free SO_3. The results do not agree with earlier data, nor these with one another, and the discrepancies are discussed. F. J. G.

Vapour pressure measurements on monofluorotrichloromethane. L. RIEDEL (Z. ges. Kälte-Ind., 1939, **46**, 197—198).—Data obtained over the range —49·64° to 55·3° are tabulated. The data can be calc. with fair accuracy from $\log p = 10{\cdot}4466 - 1995{\cdot}8/T - 1{\cdot}7697 \times 10^{-2}T + 0{\cdot}1753 \times 10^{-4}T^2$. R. B. C.

Thermodynamics of the thermomechanical effect of helium II. J. MEIXNER (Ann. Physik, 1939, [v], **36**, 578—584; cf. A., 1940, I, 103).—Theoretical. London's derivation (cf. A., 1939, I, 557), for the thermomechanical effect of He II, of a relation analogous to the Thomson relation between the thermoelectrical effects is invalidated by the assumption that the reversible, thermomagnetic, and irreversible, conductivity and frictional heating, thermal effects are separable. A relation is deduced thermodynamically without this assumption. O. D. S.

General equation of state. Equations for ammonia and steam. J. L. FINCK (J. Franklin Inst., 1940, **229**, 201—221; cf. A., 1938, I, 311).—Mathematical. The assemblage of thermodynamic states is enlarged by including the so-called metastable states, and the general equation obtained is checked by the use of available thermodynamic data for NH_3 and steam in the saturated state. The agreement in this region is good, although the equation does not hold so well for the superheated region. A. J. M.

Constants of the equation of state of Beattie and Bridgeman for water vapour. G. SARTORI (Atti X Congr. Internaz. Chim., 1938, II, 478—483).—From measurements of the compressibility of H_2O vapour between 400° and 480° taken from the literature the following vals. for the consts. of the Beattie and Bridgeman equation of state have been calc.: $c = 80 \times 10^4$, $A_0 = 8{\cdot}715$, and $a = 0{\cdot}03004$ below the crit. d, $A_0 = 7{\cdot}847$ and $a = 0{\cdot}02799$ above the crit. d, $B_0 = 0{\cdot}0935$, $b = 0{\cdot}03315$. O. J. W.

Nernst heat theorem. V. DJEGOVAN (Atti X Congr. Internaz. Chim., 1938, II, 380—390).—By taking into account a general equation of state of the form $(p + \pi)(v - b) = \boldsymbol{RT}$ changes of state can be extrapolated to 0° K. Allotropic changes of solids, sublimation, evaporation, melting, etc. are discussed. O. J. W.

Approximate solutions to problems involving the ideal gas law. A. CALANDRA (J. Chem. Educ., 1940, **17**, 15—17).—A table for the correction of gas vols. measured over H_2O to standard conditions, a nomograph for problems involving the ideal gas law, and other aids to solving gas problems are given L. S. T.

Thermodynamic surfaces of water. A. L. CLARK and L. KATZ (Trans. Roy. Soc. Canada, 1939, [iii], **23**, III, 59—70).—Theoretical. Models of thermodynamic surfaces conforming to the experimentally determined properties of H_2O (ice I, liquid and vapour) have been constructed. Four plates

illustrate models of *P–V–T* and *U–V–S* surfaces for H_2O and a line drawing of *P–V–T* H_2O surface. C. R. H.

(A) **Absolute measurements in the pressure range up to 30,000 kg. per sq. cm.** (B) **Compressions to 50,000 kg. per sq. cm.** P. W. BRIDGMAN (Physical Rev., 1940, [ii], **57**, 235—237, 237—239).—(A) In order to establish a pressure scale and an abs. compressibility for a new high-pressure range, the electrical resistance of the manganin pressure gauge was calibrated with reference to the accurately determined transition pressure between the two modifications of Bi. Hence a new fixed point, the freezing pressure of Hg at 30°, is found as 13,715 kg. per sq. cm., and from the new scale the abs. compressibility of pure Fe was found and expressed by an equation.

(B) A preliminary summary of results of measurements with an improved apparatus of the vol. decrements for 38 binary cubic compounds and for S, Se, Te, In, Sb, and Bi. N. M. B.

Thermal separation ratios calculated from viscosity data. H. BROWN (Physical Rev., 1940, [ii], **57**, 242—243).—With reference to the separation of isotopes by thermal diffusion (cf. Furry, A., 1939, I, 395), theory is developed and calc. data are tabulated for 10 elementary and 12 compound gases. Results indicate suitable mol. species for isotope separation, *e.g.*, N_2 is better than NH_3, NO, or N_2O. N. M. B.

Molecular fields of carbon dioxide and nitrous oxide. R. E. BASTICK, H. R. HEATH, and T L. IBBS (Proc. Roy. Soc., 1939, **A**, **173**, 543—554).—Further work on the thermal diffusion of CO_2 mixed with H_2 and N_2 confirms a discontinuity in the rate of increase of the coeff. of thermal separation at 145°. A similar effect is observed in N_2O at 120° and is confirmed by viscosity measurements. G. D. P.

Light-scattering. S. PARTHASARATHY (Phil. Mag., 1940, [vii], **29**, 148—153).—Examination of Krishnan's data (cf. A., 1935, 11) shows that the scattering of light observed in binary liquid mixtures is purely mol., and that no scattering arises from clusters, if any, at the crit. solution temp. The crit. solution mixture is not emulsoid. Krishnan's results appear to have been vitiated by optical errors, hence no new theory is necessary to explain his results (cf. Mueller, A., 1938, I, 437). N. M. B.

Critical opalescence of liquid complexes. P. MONDAIN-MONVAL and J. QUIQUEREZ (Compt. rend., 1940, **210**, 246—248; cf. A., 1939, I, 516).—If the partition relations are such that the conjugate solutions have nearly equal refractive indices (*n*) opalescence may not occur, even if *n* of the component liquids differ by >0·03. A. J. E. W.

Partial pressures of nitric acid–water mixtures from 0° to 20°. G. L. WILSON and F. D. MILES (Trans. Faraday Soc., 1940, **36**, 356—363).—The total and partial pressures of HNO_3–H_2O mixtures (50—100% HNO_3) have been determined by a static method at 0° and 20°, and vals. for intermediate temp. calc. from these. From the curves, and by direct measurement, the heat of vaporisation of HNO_3 is 9420—9450 g.-cal. per g.-mol. F. J. G.

Viscous behaviour of thread-like and spherical molecules, especially of glycogen and starch in compressed liquids. U. EBBECKE and R. HAUBRICH (Biochem. Z., 1939, **303**, 242—250).—High pressure (400 and 800 atm.) greatly increases η of starch solution, saturated sucrose and glycogen solutions, and animal and vegetable oils, but increases that of cow's milk, egg-yolk, fish glue, and dil. solutions of glucose, sucrose, and glycogen only slightly. When starch solution undergoes enzymic hydrolysis, η at pressures of 1 and 800 atm. and the degree to which it is affected by pressure decrease as the degree of degradation and the consequent diminution in mol. size increase. Conversely, η of polymerised styrene and the extent to which η is affected by pressure increase as the degree of polymerisation increases. W. McC.

Comparison of electrical and diffusion forces in metabolism of electrolytes.—See A., 1940, III, 259.

Arrangement in mixed crystals. J. A. A. KETELAAR (Natuurwetensch. Tijds., 1939, **21**, 249—256).—Ionic arrangements in mixed crystals of CaF_2–YF_3 and SrF_2–LaF_3 are discussed mathematically. S. C.

Internal binding energy and constitution of glass. III. Viscosity and internal binding energy of Na_2O–B_2O_3–SiO_2 glasses. IV. Internal binding energy of glass and the glassy state. T. MORIYA (J. Soc. Chem. Ind. Japan, 1939, **42**, 367B).—III. The internal binding energies have been derived from the log η–$1/T$ relationship, which is linear up to the transformation temp. The vals. increase with increasing B_2O_3 content.

IV. The probable internal binding energy–temp. curves have been examined for a series of Na_2O–SiO_2 glasses over a wide range of temp. At high temp. Na_2O–SiO_2 glass may contain Na_2O,SiO_2. D. F. R.

New uviol glasses of the binary system CaF_2–SiO_2. C. SHIN-PIAW (J. Chem. Physics, 1940, **8**, 129).—By dissolving SiO_2 in molten CaF_2 (natural or pptd.) about 20 samples of glasses containing 70—79% CaF_2 have been prepared, ρ 2·80—2·91, m.p. ~1460°. The transparency to ultra-violet radiation is in the order: quartz $\gg$ glass containing natural CaF_2 > glass containing pptd. CaF_2. The transparency of the glasses varies irregularly with ρ, particularly for those prepared from pptd. CaF_2. W. R. A.

Beta′–beta transformation in lithium–lead alloys. T. C. WILSON (J. Chem. Physics, 1940, **8**, 13—19).—Measurements of electrical resistance and thermal expansion show that the β'–β transformation (cf. Grube and Klaiber, A., 1935, 23) in Li–Pb alloys under high hydrostatic pressures occurs gradually on heating from a phase of abnormally high energy and entropy content to a normal phase. *X*-Ray analysis indicates the movement of Li atoms in the lattice to more orderly positions during transition. W. R. A.

Alpha solubility limit and first intermediary phase in copper–silicon system. A. G. H. ANDER-

SEN (Amer. Inst. Min. Met. Eng., 1939, Tech. Publ. 1126, 17 pp.; Met. Tech., 1939, **6**, No. 7).—The equilibrium diagram of the system was studied in the region 0—8% Si. The data agree with those of Smith (cf. A., 1939, I, 464) except that the temp. of the peritectoid reaction $\alpha + \beta \rightleftharpoons \kappa$ is 833°. The phase diagrams were determined by microscopic and *X*-ray methods and the most probable diagram is given. The lattice spacings of the κ phase were determined over the range 10·9—14·6 at.-% Si; the axial ratio diminishes slightly with increasing Si content. R. B. C.

Solubility of magnesium in aluminium. G. SIEBEL and H. VOSSKÜHLER (Z. Metallk., 1939, **31**, 359—364).—*X*-Ray and resistivity measurements gave the following vals. for the solubility of Mg in Al : 100°, 1·9%; 200°, 3·1%; 300°, 6·7%; 400°, 13·5%, 449° (eutectic temp.), 17·4%. The solidus passes through the points 11·3, 6·7, 3·1, and 0·3% Mg at 500°, 550°, 600°, and 650° respectively. Results published by earlier workers were obtained with insufficiently homogenised alloys, or no account was taken of the effect of quenching stresses. A. R. P.

Investigations on the strontium–aluminium system. H. NOWOTNY and H. WESENBERG (Z. Metallk., 1939, **31**, 363—364).—*X*-Ray examination of alloys with up to 50 at.-% of Sr reveals the existence of Al_4Sr and AlSr and the almost complete insolubility of Sr in solid Al. The eutectic composition is Sr 0·3 at.-%. Al_4Sr has a tetragonal face-centred lattice, *a* 4·45, *c* 11·05 A., *d* 2·98, 2 mols. per unit cell; it crystallises in hard brittle leaflets and dissolves Al up to 5 at.-% and Sr up to 5·7 at.-% at 700°. AlSr, which is stable only at high temp., has a cubic body-centred lattice with *a* 15·8 A. and 59 mols. per unit cell. A. R. P.

Ferromagnetic anisotropy in body-centred cubic iron–nickel alloys. L. W. McKEEHAN (Physical Rev., 1940, [ii], **57**, 246).—The results for the ferromagnetic anisotropy const. in alloys up to 16 at.-% Ni (cf. Tarasov, A., 1940, I, 101) agree in direction of change and order of magnitude with predictions based on a theory of magnetic interaction (cf. A., 1937, I, 503). N. M. B.

Exact measurements of specific heats of solid substances at high temperatures. XII. Specific heats of iron–nickel alloys of various compositions between 100° and 1400°. A. J. ZUITHOFF (Rec. trav. chim., 1940, **59**, 131—160; cf. A., 1939, I, 133).—Sp. heats have been determined for alloys containing ~10, 20, 30, 40, 50, 70, and 80% of Ni. The mean sp. heat ($\bar{c}_p$)–temp. curves for "reversible" alloys (Ni $\not<$40%) are nearly parallel, whilst those for "irreversible" alloys (Ni 0—30%) show a deviating course. Discontinuity at the γ–α transformation temp. is observed with Ni 10 and 20%, and strong retardation with Ni 30%. True sp. heats are deduced from the $\bar{c}_p$ vals., and formulæ are given. The heat content and sp. heat are a min. at Ni ~30%. The additive law of Neumann and Kopp is only approx. valid. F. L. U.

Thermal conductivity of badly conducting alloys between 3° and 20° K. J. KARWEIL and K. SCHÄFER (Ann. Physik, 1939, [v], **36**, 567—577).—The thermal conductivities of German silver (Ni 16, Cu 64, Zn 20%), silver-bronze (Cu 46, Zn 41, Ni 13%), contracid (Ni 60, Cr 15, Fe 16, Mo 7%), steel, and Fe have been measured between 3° and 20° K. by the method of stationary heat flow. Electrical conductivities have been measured over the same temp. range. The Wiedemann–Franz law is obeyed by Fe. The Lorenz nos. of the alloys decrease with decreasing temp. O. D. S.

Equilibrium diagram of the ternary system iron–chromium–aluminium. II. I. I. KORNILOV, V. S. MICHEEV, and O. K. KONENKO-GRATSCHOVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 907—910).—Thermal properties, micro-structure, hardness and conductivity of the ternary system Fe–Cr–Al have been investigated over the range 0—40% Al and 0—100% Cr. A region of ternary solid solutions has been found, existing in alloys quenched from 1150° and annealed at this temp. with subsequent slow cooling. The solid solubility of Al in α-Fe is decreased by the addition of Cr for quenched steels and for annealed alloys there are, in addition, transformations in the solid state. It is confirmed that the electrical resistivity increases with the concn. of the solid solutions. W. R. A.

System iron–cobalt–beryllium. W. KÖSTER (Arch. Eisenhüttenw., 1939—40, **13**, 227—230).—$FeBe_2$ and CoBe form a simple eutectiferous system with a wide solid-solubility range at each end; the eutectic is at 1180°, Co 34, Be 19·5% and the eutectic range is Co 25—38% at 1180° and 21—39% at 20°. In the ternary system there are invariant points at 1000°, liquid + $FeBe_2 = \alpha$ + CoBe, and at 1080°, liquid + $\alpha \rightleftharpoons \gamma$ + CoBe. Increase in Co decreases the solubility of Be, which is 9% with 5% of Co and 7% with 25% of Co at 1180° and 5·3 and 3% respectively at 900°; these alloys are therefore amenable to pptn.-hardening. A max. Brinell hardness of 700 is obtained by hardening the alloy with Co 15 and Be 3·5%. The effects of pptn.-hardening on the magnetic properties of the alloys are described. A. R. P.

System iron–cobalt–antimony. W. GELLER (Arch. Eisenhüttenw., 1939—40, **13**, 263—266).—$FeSb_2$ and $CoSb_2$ form a continuous series of solid solutions as also does CoSb with the ε Fe–Sb phase. In the Fe–Co–CoSb–ε section of the ternary system the reaction $\gamma + \varepsilon \rightleftharpoons$ liquid in the Co–Sb system at 1098° merges with the α + liquid $\rightleftharpoons \gamma$ reaction at 1493° in the Fe–Sb system in a plane of four-phase equilibrium at 1000°. On cooling this divides into two reactions: α + CoSb–ε solid solution $\rightarrow$ liquid, ending at 988°, and $\alpha + \gamma \rightarrow$ CoSb–ε solid solution ending at 20°. In the CoSb–ε–Sb section the reaction CoSb–ε solid solution + liquid $\rightarrow$ $CoSb_2$–$FeSb_2$ solid solution starts at 894° at the Co side and ends at 230° at the Fe side, whilst the reaction $CoSb_2$–$FeSb_2$ solid solution + Sb $\rightarrow$ liquid starts at 628° at the Fe side and ends at 618° at the Co side. No useful properties are developed in any of the alloys by pptn.-hardening treatment. A. R. P.

Equilibrium diagram of the iron–iron silicide–tungsten system. R. VOGEL and H. TÖPKER (Arch. Eisenhüttenw., 1939—40, **13**, 183—188).—The

equilibria as determined by thermal and micrographic methods are shown in ternary and sectional diagrams. W and FeSi form the compounds FeWSi (I), m.p. ~1900°, and FeW_2Si (II), decomposed at 2200° into liquid + W. (I) and (II) form a eutectic at ~1820°, W 73%, and (I) and FeSi a eutectic at 1360°, W 21%. Fe_3Si_2 combines with (I) to form the compound Fe_7WSi_5 with which it yields a continuous series of solid solutions (III) which crystallise in a characteristic form in alloys containing these two compounds. In the system Fe–FeSi–W the primary crystallites consist of α-Fe, FeSi, (I), 98% W solid solution, and Fe_3W_2, and there are five points of four-phase equilibrium: (*a*) liquid + (II) $\rightleftharpoons$ (I) + W at 1750°; (*b*) liquid + W $\rightleftharpoons$ (I) + Fe_3W_2 at 1620°; (*c*) liquid + Fe_3W_2 $\rightleftharpoons$ α-Fe + (I) at 1420°; (*d*) liquid $\rightleftharpoons$ α-Fe + FeSi + (I) at 1175°, eutectic composition W 4, Si 18, Fe 78%; (*e*) corresponds with the separation of (III) from the melt. A. R. P.

Solubility and diffusion of oxygen in solid iron.—See B., 1940, 209.

Solubilities of inorganic compounds in ordinary water and in deuterium water. R. D. EDDY and A. W. C. MENZIES (J. Physical Chem., 1940, **44**, 207—235).—The solubilities over wide temp. ranges of various halides and sulphates in H_2O and D_2O have been measured, and the transition temp. (θ) of salt deuterates have been evaluated and compared with θ of the corresponding hydrates. θ for the deuterate was higher in the case of Na_2SO_4 and $CuSO_4$ and lower in the case of NaBr, NaI, $BaCl_2$, and $SrCl_2$ than for the corresponding hydrate. All of these θ are incongruent m.p. A new metastable *hydrate* and *deuterate* of NaI of uncertain composition are reported. C. R. H.

Solubility of alkali sulphates and carbonates in ammonia-water mixtures. A. GUYER, A. BIELER, and E. VON ORELLI (Helv. Chim. Acta, 1940, **23**, 28—33).—Solubilities of Na, K, and NH_4 sulphates and carbonates in 0—100% of NH_3 over the range −30° to 20° are recorded graphically. In each case solubility decreases with increase in $[NH_3]$ and with decrease in temp. At the lower temp. the solubilities over the range 20—100% of NH_3 are almost const. C. R. H.

Precipitation of aluminium hydrous oxide and its solubility in ammonia. E. B. R. PRIDEAUX and J. R. HENNESS (Analyst, 1940, **65**, 83—87).—The solubility of hydrous Al_2O_3 (from amalgamated Al) in aq. NH_3 is min. at ~2N. after 1 day. Keeping in contact with the solid causes the solution to deposit ~90% of its Al_2O_3 in 6 days. This process is greatly accelerated by NH_4 salts. In quant. analysis it is best to add N—2N-NH_3 to the solution containing NH_4 salt, digest the ppt. in a closed tube at ~90°, and then boil off excess of NH_3 and filter. F. L. U.

Solubility of calcium oxalate in various salt solutions. H. SHEHYN and D. B. PALL (J. Physical Chem., 1940, **44**, 166—171).—Solubilities of CaC_2O_4 in solutions of NH_4Cl, $(NH_4)_2SO_4$, NH_4NO_3, and Na_2SO_4 over a range of salt concns. and temp. are recorded. C. R. H.

Solubility of glycine anhydride. K. H. MEYER and O. KLEMM (Helv. Chim. Acta, 1940, **23**, 25—27).—With increasing concn. of NaCl, NaBr, NaI, KI, and LiI the solubility (*s*) of glycine anhydride (diketopiperazine) in H_2O at 20° increases. With KCl, KBr, and particularly LiBr there is an initial fall in *s* followed by an increase. Addition of KF continuously decreases *s*. The data are briefly discussed in relation to the influence of electrolytes on the solubility of NH_2-acids and proteins. C. R. H.

Saponins. IV. Effect of sapoalbin on crystallisation of barium sulphate. R. G. RUYSSEN (Natuurwetensch. Tijds., 1939, **21**, 198—204).—Small amounts (19 and 29 mg. per l.) of Na saponinate (I) accelerate and larger amounts (70—100 mg. per l.) retard crystallisation of $BaSO_4$ (0·00017M. per l.). Supersaturation occurs with ~100 mg. of (I) per l. In presence of (I) the cryst. form of $BaSO_4$ is abnormal. S. C.

Effect of molecular concentration of aqueous phase on the partition coefficient of *iso*propyl alcohol between water and oil. A. LINDENBERG and F. WINTERNITZ (Compt. rend. Soc. Biol., 1939, **131**, 1085—1087).—The partition coeff. between olive oil and water (0·07) is independent of the concn. of the alcohol. It is increased by dissolving crystalloids in the aq. phase proportionally to their mol. concn. H. G. R.

Distribution of nicotine between water and petroleum oils. L. B. NORTON (Ind. Eng. Chem., 1940, **32**, 241—244).—The distribution of nicotine (I) between H_2O and certain petroleum oils has been studied. In dil. (<1%) solution there is a const. distribution ratio ~1·1 in favour of H_2O which with increasing concn. increases to a max. ~7 at 50—70% and then decreases again. Acids in excess extract (I) completely into H_2O, but alkalis tend to drive it into oil; (I) is completely extracted by oil from 5N-NaOH. F. J. G.

Catalytic isotope exchange of gaseous oxygen. V. Sorption of oxygen by manganic oxide and the exchange reaction of gaseous oxygen and manganic oxide. I. Sorption investigations. N. MORITA (Bull. Chem. Soc. Japan, 1939, **14**, 520—529; cf. A., 1939, I, 87, 207).—The sorption of O_2 by Mn_2O_3 has been investigated kinetically under const. pressure ($\frac{2}{3}$ atm.) at various temp. At room temp. the rate of sorption is scarcely measurable and is still very low at 275°. At 325° the rate is 15 times that at 275°. The increase in the amount of gas sorbed continues up to 530°, but if the product thus obtained is heated above 530° a rapid desorption of O_2 takes place and part of the O of the Mn_2O_3 is also lost. If, however, the temp. of the partly decomposed oxide is reduced it will take up O again and the process of oxidation and decomp. can be repeated indefinitely. T. H. G.

Rare gases. IV. Formation of mixed crystals between the rare gases and other substances. V. Combination of radon with phenol. B. A. NIKITIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 562—564, 565—567; cf. A., 1936, 676).—IV. The distribution of Rn between solid and gaseous phases after crystallisation direct from the gas phase

containing Rn of NH_3, HCl, H_2S, SO_2, and CO_2, and after long periods of contact at low temp. with finely divided crystals of H_2O, NH_3, PhOH, NH_2Ph, HCl, HBr, H_2S, SO_2, CO_2, and $COMe_2$ has been investigated. Except in the case of H_2O, NH_3, PhOH, and NH_2Ph large amounts of Rn are taken up by the crystals. The presence of CO_2 in the gas phase does not diminish the amount of Rn taken up by SO_2 crystals. A is taken up by HCl but not by NH_3. Ne is not taken up by either HCl or NH_3.

V. The distribution of Rn between solid and gaseous phases when in contact at 15° (below the eutectic temp. of PhOH and the compound H_2S,2PhOH) with PhOH and H_2S has been investigated. The distribution function $[Rn]_{cryst.}[H_2S]_{gas}/[Rn]_{gas}[H_2S]_{cryst.}$ is const. and $\sim$1·25. The distribution const. for A, $[A]_{cryst.}[H_2S]_{gas}/[A]_{gas}[H_2S]_{cryst.}$, is 0·002.

O. D. S.

Adsorption of non-polar gases on alkali halide crystals. W. J. C. Orr (Proc. Roy. Soc., 1939, **A**, **173**, 349—367; cf. A., 1939, I, 560).—A method is described which is sufficiently sensitive to measure the small amounts of A, O_2, and N_2 adsorbed on KCl and CsI. Adsorption isotherms have been determined and heats of adsorption as functions of the amount adsorbed deduced. The heat of adsorption has a max. when the first monolayer is completed. After the completion of the monolayer it is inferred that adsorption continues by the formation of layers rather than by the formation of localised aggregates.

G. D. P.

Structure and formation of immobile adsorbed film; adsorption of oxygen on tungsten. J. K. Roberts (Proc. Camb. Phil. Soc., 1940, **36**, 53—68).—Theoretical. The adsorption on a simple quadratic lattice of particles large enough to occupy more than one site is not homogeneous; gaps occur in the film where groups of particles occupying different types of sites meet. Possible configurations in the boundary regions are discussed. In the case of O on W a second, less stable, layer is formed on the boundary regions.

L. J. J.

Discontinuities in adsorption processes. H. H. Chambers and A. King (J.C.S., 1940, 156—166).—Conclusive evidence for discontinuous adsorption has been obtained from measurements of the adsorption of H_2O vapour and CCl_4 on SiO_2 gel and sugar charcoal, of $CHCl_3$ on Cr_2O_3, and of H_2O and NH_3 on chabasite. The adsorption on chabasite appears to bear no relation to the known breakdown of structure which occurs during adsorption since the adsorption of NH_3, which causes considerable disintegration, gives a smoother isotherm than does that of H_2O, with which disintegration is almost negligible. The data are discussed with reference to current theories but no satisfactory explanations can yet be offered.

C. R. H.

Chromic oxide as an adsorbent. E. H. Harbard and A. King (J.C.S., 1940, 19—29).—The adsorption of a no. of vapours by Cr_2O_3, and the dependence of its sorptive power on the mode of prep., have been studied. Modes of prep. involving rapid evolution of large amounts of gas at a relatively low temp. favour high sorptive power, and this is but little impaired by subsequent heating to higher temp. The most active specimens are obtained by decomp. of $(NH_4)_2Cr_2O_7$. The isotherms are of sigmoid type and indicate Langmuir adsorption at lower pressures, passing over into capillary condensation at higher pressures. On the assumption that the relationship between capillary radius and v.p. is $r = k/\log p$, the curves for CCl_4 are analysed and relationships between capillary radius, surface area, and mass of vapour adsorbed are deduced. On similar adsorbents, the amount adsorbed at a given fraction of the v.p. decreases in the order $CCl_4 > CH_2Cl_2$ and $CHCl_3 > H_2O$. The curves for CH_2Cl_2 and $CHCl_3$ coincide in the capillary region. The curve for H_2O has a long linear portion suggesting a third type of sorption. On repeated sorption and desorption the sorptive power decreases markedly, probably owing to disruption of the smaller capillaries. The isotherms have a discontinuous fine structure in both the Langmuir and the capillary regions.

F. J. G.

Drift of the hysteresis loop in sorption. K. S. Rao (Current Sci., 1939, **8**, 546—548).—A series of sorptions and desorptions of H_2O vapour at 30° has been conducted on Fe_2O_3 gel and their characteristics are described. Among other changes produced by progressive sorptions and desorptions is the decrease in size of the hysteresis loop, which drifts away from the axis representing the amount of H_2O absorbed. The sorption isotherm, as for the system TiO_2–H_2O (A., 1940, I, 68), shows an inflexion beyond which there is a rapid increase in the sorption capacity of the gel, indicating a change from unimol. adsorption to capillary condensation. The decrease in the sorptive capacity at saturation pressure shows a decrease in the total capillary vol. The data are discussed in the light of the cavity concept of hysteresis. The unique behaviour of this system is probably connected with the thixotropy of the Fe_2O_3 gel, by virtue of which the particles have the power to coalesce.

W. R. A.

Adsorption of dipoles. A. R. Miller (Proc. Camb. Phil. Soc., 1940, **36**, 69—78).—Theoretical. Statistical treatment using Bethe's approximation gives formulæ for the adsorption isotherm of dipoles and the variation of heat of adsorption with degree of covering; van der Waals and electrostatic interaction terms in the latter are approx. equal and of opposite sign.

L. J. J.

Polarisation and change of colour during adsorption on superficially active substances. E. Weitz and F. Schmidt (Ber., 1939, **72**, [*B*], 2099—2107).—CPh_3·OH is adsorbed from its colourless solution in C_6H_6, $CHCl_3$, etc. by SiO_2 gel with a brown-yellow and by Al_2O_3 with a yellow colour, discharged on addition of EtOH or $COMe_2$. H_2O has a particularly marked effect so that the activity of an adsorbent is greatly dependent on its dryness. CPh_3·OH is adsorbed only by well-dried SiO_2 gel whereas the more readily polarisable CPh_3Cl is adsorbed by the air-dried material with a yellow colour. The di- and tri-aminotriphenylcarbinols are still more readily adsorbed with the colours of their dye salts. CPh_3·CN gives a colourless adsorbate and hence is not a ψ-salt but a true nitrile. Conversely the yellow alkiodides of quinoline and *iso*quinoline and the red 5-nitroquinoline

methiodide give colourless adsorbates on SiO_2 gel or Al_2O_3 as a consequence of the accompanying polarisation (ionisation). HgI_2 vapour at 180° gives a colourless adsorbate on SiO_2 gel which can be thus kept if sealed or in presence of P_2O_5. Exposure to air causes the displacement of colourless HgI_2 by atm. moisture. The behaviour of $Fe(CNS)_3$, $CuBr_2$, and BiI_3 is described. Extended observations have been made with compounds which have an unsaturated chromophor (an "anionic" group such as >C:O, >C:NR, -C:N, -N:O, or -N:N-) and auxochromic (cationic) groups, ·NR_2, ·OR, or ·SR, separated by an even no. of alternately doubly and singly bound C (or N) atoms. All such compounds (except *p*-NO·C_6H_4·NMe_2) are absorbed from C_6H_6 or $CHCl_3$ on SiO_2 gel or active Al_2O_3 with darkening of colour. Adsorption is accompanied by polarisation of the mol. The experiments therefore support the theory that in these compounds the anionic and cationic portions influence one another by mutual oxidation and reduction, that is with electron displacement or polarisation. The adsorbates are usually decomposed by a small addition of EtOH or $COMe_2$. Org. dipolar substances give frequently very unstable complex compounds with $AlCl_3$; their initial colour is generally similar to that of their adsorption compounds. Nitron is decolorised by adsorption or by salt formation; an explanation is lacking. H. W.

Thermodynamics of interfaces in systems of several components. I, II. E. A. GUGGENHEIM (Trans. Faraday Soc., 1940, **36**, 397—407, 407—412). I. Mathematical. The thermodynamic properties of a plane interface are derived by treating the interface as having a finite thickness (τ). Formulæ, invariant with respect to τ, are obtained for the relation between γ and temp. and between γ and the composition of one of the bounding phases. The treatment is correlated with that of Gibbs.

II. The formulæ derived for plane interfaces are applicable to curved interfaces provided τ is $\ll$ the radius of curvature. F. L. U.

Influence of interfacial curvature on solubility. R. S. BRADLEY (Trans. Faraday Soc., 1940, **36**, 392—394).—The increase of solubility (or v.p.) of small droplets compared with that of a plane surface of the same material is derived from a law of intermol. force. The expression deduced is substantially the same as Kelvin's, the vals. given by the two methods differing by ~8 and 13% when the radius is respectively 10 and 5 times the mol. diameter. The method possesses the advantage (over Kelvin's) of avoiding the assumption of constancy of interfacial energy and is therefore applicable to droplets of the smallest size; it cannot, however, be applied to cryst. solids. F. L. U.

States of monolayers on an aqueous subphase. W. D. HARKINS and E. BOYD (J. Chem. Physics, 1940, **8**, 129—130).—A monolayer is part of an interficial region which may be considered to consist of phases in two dimensions analogous to a Gibbs phase in three. As the pressure is increased the usual transitions along an isotherm are: gas → liquid (I) (expanded) → intermediate → solid. The first transition is first-order and the last second-order. The intermediate phase may consist of $\nless$ two parts, (i) transition, with great compressibility, exhibits hysteresis, changing gradually to (ii) liquid (II) (condensed), compressibility relatively low. The analogy to a three-dimensional liquid is close in that liquid (I) is formed by a first-order change from a gaseous film, and that liquid (II) has a similar coeff. of expansion and compressibility. The data of Dervichian are considered. Present data on pentadecoic and related acids (14 to 20 C) and alcohols (14—18 C) indicate that the nature of the transitions in condensed states depends on the closeness of packing of the cylindrical mols. (elliptic cylinders), but that for any particular type of transition the hydrocarbon chains are drawn closer together as increased chain length increases the van der Waals forces between them. W. R. A.

Statistical mechanics of condensation phenomena in mobile monolayers. W. BAND (J. Chem. Physics, 1940, **8**, 116—119).—A modification of the dissociation treatment developed previously (A., 1940, I, 18) covers the condensation phenomena observed in mobile monolayers. Saturated tension equations depend only on the no. of linkings with nearest neighbours, and the mean energy per linking per mol. in the condensed phase. Good agreement has been obtained with the curves of Adam and Jessop (A., 1926, 348) for the fatty acids, with six linkings with a mean energy of $3{\cdot}7 \times 10^{-14}$ erg per linking per mol. W. R. A.

Viscosity of surface layers of proteins. M. JOLY (J. Chim. phys., 1939, **36**, 285—295).—An arrangement is described for determining surface viscosities (μ) by the oscillations of a mica ring floating in the surface of a liquid, other parts of which are provided with barriers for altering the area and for measuring the surface pressure. Layers of protein (egg- and serum-albumin, hæmoglobin, gliadin) spread from the solid on H_2O or 0·01N-HCl are of two kinds, viz., *A*, formed by spreading at low pressures, and characterised by low μ, high stability, and reproducibility of property measurements, and *B*, formed by spreading at higher pressures, having much higher μ, and showing irreversible ageing. In *B* layers rise of temp. causes increase of μ at const. pressure. F. L. U.

New "ageing" phenomenon in unimolecular films on water. F. SEBBA and H. V. A. BRISCOE (J.C.S., 1940, 128—131).—Films of *n*-docosanol lose their resistance to the evaporation of H_2O with time. The magnitude of the ageing effect varies directly with time and inversely with the surface pressure during ageing. Explanations of ageing are suggested, the most probable being that in an uncompressed film on H_2O there occurs a slow, progressive, and possibly reversible association of the film-forming mols.; *e.g.*, alcohol mols. which lie on the H_2O surface may unite to form double mols., combining so that the hydrophilic groups are at opposite ends of the double mol. Even when compressed such a dihydric alcohol would tend to lie on the H_2O surface, thus enhancing the permeability of the film. C. R. H.

Variation of the solubility of unimolecular films with surface pressure, and its effect on the measurement of true surface pressure. F.

SEBBA and H. V. A. BRISCOE (J.C.S., 1940, 114—118).—The surface pressure exerted by a film on H_2O is not const. for a given temp. Experiments with several films are described and the variations from constancy are attributed to the slight solubility of the films in H_2O. Instead of a sharply defined unimol. layer, the films are regarded as less definite layers of pure surface-active substance containing a small quantity of H_2O in solution. These layers are in pseudo-equilibrium with H_2O containing a small quantity of the film substance in solution, the amount of the latter decreasing as the distance from the film layers is increased. C. R. H.

Evaporation of water through unimolecular films. F. SEBBA and H. V. A. BRISCOE (J.C.S., 1940, 106—114).—An apparatus, which allows the passage of a const. stream of dry air over a known area of H_2O surface with and without a film, and permits the determination of the evaporated H_2O, is described. The resistance offered by surface films to the evaporation of H_2O depends not only on the nature of the film but also on the surface pressure. Films of egg-albumin, cholesterol, oleic and elaidic acids offer negligible resistance, whereas stearic, brassidic, and arachidic acids, cetyl and octadecyl alcohols, and *n*-docosanol offer a strong resistance under suitable conditions. Each substance has a crit. surface pressure, F_c, below which the resistance is small; above F_c, which is generally > the pressure at which the film becomes incompressible, the resistance increases considerably. The effect of hydrophilic groups in the chain of the film mol. is to reduce the resistance of the film, and increased length of chain tends to lower F_c. A greater resistance to evaporation is obtained with a closely packed film 1 mol. thick than with a lubricating oil film ~100 mols. thick. C. R. H.

Wetting characteristics of solid surfaces covered with adsorbed films. F. E. BARTELL and K. E. BRISTOL (J. Physical Chem., 1940, **44**, 86—101).—A method of measuring contact angles on hydrophilic surfaces is described. Using advancing and receding contact angles as measures of the wetting properties of solid surfaces, it has been shown that hydrophilic solids (Pyrex, SiO_2, gypsum, mica, fluorite, and celestine) in an atm. of high R.H. adsorb films on their surfaces sufficient to mask the original surface properties, so that $C_2H_2Br_4$ and 1-$C_{10}H_7Br$ yield the same contact angle on each of these surfaces. Strongly organophilic solids (stibnite, galena, cinnabar) tend to give the same effect in presence of polar org. vapours, but with less organophilic materials (sphalerite and oxidised stibnite) and with non-polar org. vapours adsorbed films may be formed which are swept away by H_2O. It is shown that the γ of films of polar liquids ($C_2H_2Br_4$ and 1-$C_{10}H_7Br$) is > for the liquid in bulk, but for the non-polar dekalin the vals. are equal. J. W. S.

Contact angles of built-up multilayers. J. J. BIKERMAN (Trans. Faraday Soc., 1940, **36**, 412—416; cf. A., 1939, I, 255).—Large wetting angles have been determined by measuring the marks left by drops of known size on solid surfaces. Measurement of the wetting angles (θ) between air, H_2O, and built-up multilayers of Ba palmitate, Ca and Ba stearates, $C_{18}H_{37}\cdot NH_2$, and $C_{18}H_{37}\cdot OAc$ shows that *X*-films are deposited when θ is >94°, *Y*-films when θ is >80° and <92°, and *Z*-films when it is <80°. The theory of contact angles is briefly discussed. F. L. U.

Surface structure of passive iron. P. D. DANKOV and N. A. SCHISCHAKOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 553—555).—The structure of the passive layer produced on very thin films of Fe by $K_2Cr_2O_7$ or by HNO_3 has been studied by electron diffraction. The lattice const. of the passive layer is equal to that of macroscopic γ-Fe_2O_3. O. D. S.

Mutual electrical energy of two colloidal particles: general theory, using approximate Debye–Hückel equation. S. LEVINE and G. P. DUBE (Phil. Mag., 1940, [vii], **29**, 105—128; cf. A., 1939, I, 520, 610).—Mathematical. A general method of determining the mutual electrical energy of two identical spherical colloidal particles is developed so as to simplify the determination of the higher approximations. Both metallic and insulating particles are treated. N. M. B.

Influence of Brownian movement on viscosity of solutions. R. SIMHA (J. Physical Chem., 1940, **44**, 25—34).—Mathematical. The calculation of the viscosity of dil. solutions of non-spherical particles as a function of their dimensions and concn. is discussed. The sp. viscosity is calc. for the case of complete Brownian movement where the velocity gradient of flow in the viscometer is small relatively to the rotational diffusion const. of the particles and hence the thermal motion produces an isotropic distribution of the particle axes in the fluid. Possible extensions of the theory are discussed. J. W. S.

Water-in-oil emulsions. III. Effect of the relative phase volumes on the type of emulsions stabilised by magnesium oleate. R. C. PINK (J.C.S., 1940, 211—212).—H_2O-in-C_6H_6 emulsions containing 90% of H_2O are possible in presence of sufficient Mg oleate (I) as stabiliser. When H_2O was added to C_6H_6 and the mixture then shaken, H_2O-continuous emulsions were formed if >50% of H_2O was present. On keeping, a reversal of type took place, especially when large amounts of (I) had been used. With 2 g. of (I) per 100 c.c. of emulsion, reversal of type took place except with emulsions containing >70% of H_2O. If, however, H_2O was added to C_6H_6 gradually and with const. agitation, C_6H_6-continuous emulsions, which were more stable than the corresponding H_2O-continuous emulsions, were formed. C. R. H.

Preparation of colloidal particles possessing a required diameter. J. LOISELEUR and R. H. SCHMITZ (Compt. rend. Soc. Biol., 1939, **132**, 435—438).—The size of the colloidal particles of gamboge can be altered by the introduction of varying quantities of soap solution. H. G. R.

Nuclear gold sols. II. Mechanism of formation. A. BAKER and F. L. USHER (Trans. Faraday Soc., 1940, **36**, 385—392).—The action of PH_3 and of H_2S on dil. aq. $KAuCl_4$ gives rise under certain conditions to nuclear Au sols. Sols of AuP and of Au_2S_3, the properties of which are described, are respectively

formed as intermediate products; evidence for the formation of AuP as an intermediate product in the prep. of Faraday sols has also been obtained. There is no change in the total no. of particles when a nuclear Au sol is made from one of AuP by oxidation. It is inferred that nuclear Au sols are produced by the conversion of preformed particles of an insol. Au compound into the metal by a solid reaction, and that the smallness of the particles is a consequence of the high speed of the intermediate reaction. F. L. U.

p_H change in gold sol formation. C. L. THROCKMARTIN and C. H. SORUM (J. Physical Chem., 1940, **44**, 247—255).—Measurements of the p_H change during the formation of Au sols made by reducing alkaline solutions of $AuCl_3$ with CH_2O are recorded. The p_H–time curve is in four parts. The first, in which dp_H/dt decreases with time, probably represents the formation of $KAuO_2$. The second, which shows a slowly accelerated increase in p_H, is the induction period during which nuclei are forming. The third shows an increased rate of reaction and a rapid increase in p_H during which colour (blue → violet → orange-red) develops. The fourth, during which the increase in p_H slackens, possibly indicates OH′ adsorption by the colloid particles. The data verify the autocatalytic nature of the reduction of $KAuO_2$ by CH_2O. C. R. H.

Chemical preparation of colloidal suspensions in non-aqueous solvents. I. Methyl alcohol and benzene. II. Ether, dioxan, and acetone. A. A. VERNON and H. A. NELSON (J. Physical Chem., 1940, **44**, 12—20, 21—25).—I. By reduction of 0·001—2% solutions of their salts in presence of cellulose nitrate ($\nless$0·2%) with N_2H_4, $SnCl_2$, tannin, P, H_2, or P + N_2H_4, stable sols of Au, Ag, Pb, Bi, Sb, Ni, Cr, Co, Cu, Hg, Sr, and Sn have been obtained in MeOH. By reduction in presence of rubber stable sols of Au, Ag, and Bi have also been obtained in C_6H_6. Metal sols without protective colloid are very short-lived. Sols of Ag_2S, PbS, Bi_2S_3, Sb_2S_3, Hg_2S, NiS, CoS, SnS, FeS, CuS, As_2S_3, and CdS have been produced by passing dry H_2S through dil. solutions of their salts in MeOH and C_6H_6.

II. Colloidal suspensions of several metals in Et_2O, dioxan, and $COMe_2$ have been prepared by reduction of their salts with N_2H_4, $SnCl_2$, P, or P + N_2H_4 in presence of cellulose nitrate or rubber as protective colloid. Metallic sulphide sols in the same media have been produced by the interaction of metallic salts with dry H_2S. Suspensions in org. media decrease in stability in the order MeOH > dioxan > C_6H_6 > Et_2O > $COMe_2$. J. W. S.

Osmotic pressure. Influence of chemically indifferent substances. (MME.) A. DOBRY and O. C. HUIN (J. Chim. phys., 1939, **36**, 296—307).—Measurements of the osmotic pressure (Π) of colloidal solutions in dispersion media to which a chemically indifferent substance is added show that with increase in the concn. of added substance Π generally increases at first, reaches a max., and then decreases. This is true when the colloid is ionised and the added substance non-ionised (K-containing Cu ferro- and ruthenocyanide in H_2O, with addition of EtOH or of $COMe_2$), when the colloid is non-ionised and the added substance ionised [cellulose nitrate or acetate in $COMe_2$ with $Ba(ClO_4)_2$; polystyrene in COMeEt, with $Ba(ClO_4)_2$], and when both are non-ionised (polystyrene in CCl_4, with AcOH; cellulose acetate in $CHCl_3$, with EtOH). The variations in Π produced by the additions increase with increasing concn. of the colloid, and become negligibly small at very low concn. F. L. U.

Hydrous lanthanum hydroxide as emulsifying agent. T. MOELLER (J. Physical Chem., 1940, **44**, 259—263).—Hydrous $La(OH)_3$, whether colloidally dispersed, flocculated from a sol by electrolytes, or pptd. from La salt solutions, stabilises aq. emulsions of C_6H_6, PhMe, xylene, $C_6H_3Me_3$, kerosene, petrol, or turpentine, but emulsions with Et_2O, *iso*-C_5H_{11}·OH, CCl_4, or $CHCl_3$ are not stabilised. The stabilised emulsions are all of the oil-in-H_2O type. When mutually flocculated by colloidal Au, $La(OH)_3$ loses its emulsifying power. Although the adsorption of Au on the ppt. reduces the active surface of the $La(OH)_3$ and the reduction in emulsifying power can thereby be explained, such explanation conflicts with the emulsion-forming properties of $La(OH)_3$ when flocculated by electrolytes. C. R. H.

Effect of ultra-violet light on ferric hydroxide sols and their purification by photo-dialysis. M. QURESHI and P. N. RAO (J. Osmania Univ., 1938, **6**, 33—36).—An 8-hr. exposure to ultra-violet light causes hydrolysis of the $FeCl_3$ in the sol, lowering the p_H by 0·2. A 40-hr. exposure increases the p_H by 0·1, possibly owing to the destruction of the HCl produced by hydrolysis; exposures >40 hr. cause slight coagulation. By exposing a sol to ultra-violet light during dialysis the time of purification may be reduced. D. F. R.

Colloidal behaviour of clays as related to their crystal structure. T. F. FORD, A. G. LOOMIS, and J. F. FIDIAM (J. Physical Chem., 1940, **44**, 1—12).—Materials such as Na tannate, $Na_6P_6O_{18}$, Na silicate, $Na_4P_2O_7$, and various Na polyphosphates, small concns. of which reduce the apparent viscosity of conc. clay suspensions, appear to be adsorbed on sp. parts of the crystal faces, thereby preventing the aggregation of the particles into structures. The gelling and coagulating effects of most salts are attributed to changes in the concn. of the interparticle ionic atm. The amphoteric behaviour of clays is discussed with reference to their mol. structures. J. W. S.

Silicic acid gels. IX. Effect of change of p_H on time of set of acid gels. C. B. HURD and H. W. PATON (J. Physical Chem., 1940, **44**, 57—62; cf. A., 1938, I, 139).—The time of setting of a gel produced by mixing aq. Na silicate and AcOH, and containing excess of AcOH, can be increased by addition of either more H_2O or more AcOH. There is no period during setting when the process is abnormally sensitive to changes in p_H, and for any particular composition of the mixture the time of setting varies linearly with the time which is allowed to elapse before any particular addition is made. J. W. S.

Viscosimetric and osmometric measurements with nitrocelluloses.—See B., 1940, 195.

Optical polarisation analysis of process of deformation of isotropic hydrous cellulose fibres. I. Double refraction in the unswelled state. II. Double refraction in the swelled state. P. H. Hermans and P. Platzek (Z. physikal. Chem., 1939, **185**, 260—268, 269—305; cf. A., 1939, I, 141, 522).—I. The optical anisotropy of air-dried viscose fibres depends on their previous history, and especially on the "characteristic extension," in the samo way as the "swelling anisotropy."

II. Wiener double refraction curves for viscose fibres of varying previous history, including swelling in various liquids, are given. From these an orientation factor is deduced, the dependence of which on the "characteristic extension" is similar to that of the "swelling anisotropy." It is concluded that the isotropic fibres consist of disordered fibre mols., and that on deformation these become both longitudinally oriented and transversely ordered. F. J. G.

Structure of gelatin sols and gels. VI. Adsorption of water vapour and electrical conductivity. S. E. Sheppard, R. C. Houck, and C. Dittmar (J. Physical Chem., 1940, **44**, 185—207).—Little difference is observed between the adsorption of H_2O vapour by lime- and acid-processed gelatin (I) having respective isoelectric points of p_H 4·8 and 8·2. Only at high humidities does the former adsorb considerably more H_2O than the latter. Adsorption is independent of the thickness of the (I) up to 0·29 mm., above which it decreases. Moisture regain decreases with decreasing p_H of the sol at coating. (I) dried at a higher temp. adsorbs slightly less H_2O than that dried at a lower temp. The adsorption isotherms resemble the typical S-shaped curves obtained for silk, wool, and cellulose, and similar hysteresis is observed on desorption. Electrical conductivity increases with moisture content and shows a min. at the isoelectric point, although moisture regain vals. do not indicate this. The data are discussed in connexion with X-ray diffraction studies of (I) structure. C. R. H.

Theory of Liesegang's rings. F. M. Schemjakin and P. F. Michalev (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 201—203).—The conception that Liesegang's rings result from the formation of standing electromagnetic waves makes it possible to explain the physical sense of Führt's established analogy between the generalised diffusion equation and the generalised wave equation and the physical sense of the emission theory of Liesegang's rings. Calc. vals. of the diameter of the rings for MnS and $Ag_2Cr_2O_7$ on this basis coincide with experimental data. F. H.

Influence of sol concentration on flocculation values. E. D. Fisher and C. H. Sorum (J. Physical Chem., 1940, **44**, 62—70; cf. A., 1935, 700).—It is confirmed that when sufficient $CrCl_3$ is added to a $Cr(OH)_3$ sol the flocculation val. (c) is increased for all cations, and for univalent ions decreases as the sol is diluted. Increased additions of $CrCl_3$ cause c for all ions to decrease more rapidly with dilution. In sols of $Cr(OH)_3$ in aq. EtOH the c for NaCl increases less rapidly with dilution than in aq. sols, and in presence of ~40% of EtOH c decreases with diminishing sol concn. EtOH increases the c of As_2S_3 sol by KCl more than does H_2O, the effect being attributed to diminution in the surface tension and hence in the adsorption of electrolyte. Traces of Na_2S increase the c of As_2S_3 sols, but diminish the increase in c which occurs on dilution. The c for MnO_2, Fe_2O_3, SnO_2, and Al_2O_3 sols either decreases, or first increases and then decreases (MnO_2), on dilution with EtOH. The effect of EtOH is attributed to its dehydrating action. J. W. S.

Mutual coagulation of colloidal solutions. II. Interaction of Prussian-blue and (a) thorium hydroxide and (b) ceric hydroxide sols. P. M. Barve, V. C. Vora, and B. N. Desai (J. Univ. Bombay, 1939, **8**, Part 3, 134—138).—Mutual coagulation of Prussian-blue with $Th(OH)_4$ and with $Ce(OH)_4$ is similar to that with $Fe(OH)_3$ (cf. A., 1938, I, 195). The lowest val. of the width of the zone of mutual coagulation for the last pair was < that for the first two pairs. This is attributed to the hydration of $Th(OH)_4$ or $Ce(OH)_4$. F. R. G.

Properties of detergent solutions. X. Electrophoretic mobilities in detergent solutions. J. Powney and L. J. Wood (Trans. Faraday Soc., 1940, **36**, 420—426; cf. A., 1940, I, 114).—Additional data are recorded. The max. mobility of Nujol in solutions of paraffin-chain salts occurs at concns. which decrease with increasing chain length. The mobility (u) increases with rise of temp. less fast than would be expected from the decrease in η, presumably owing to decreased adsorption at higher temp. Generally increase of chain length leads to higher vals. of u, especially in very dil. solutions. Addition of NaCl lowers or raises the u of Nujol in Na tetradecyl sulphate, according to whether the concn. of the latter is > or <0·03%. u has also been measured for hard paraffin, Ca laurate, and ilmenite. F. L. U.

Calculation of chemical equilibrium at high pressures. R. H. Ewell (Ind. Eng. Chem., 1940, **32**, 147—153).—Examples are given of the thermodynamical calculation of equilibrium consts. for gas reactions. At high pressures a modification of van der Waals' equation, viz. $[p + (a/v^{7/4}T)](v - b) = \boldsymbol{R}T$, which fits experimental data for CO_2, N_2, and CH_4, is used. Synthesis of HCN from C_2H_2 and N_2 at high pressures should be practicable. F. J. G.

Probable solvation of aniline hydrochloride, aniline hydriodide, and α-naphthylamine hydriodide in aniline solution. Simple mathematical treatment. H. H. Hodgson and E. Marsden (J.S.C.I., 1940, **59**, 23—24).—Assuming (1) that dil. solutions of NH_2Ar,HX (X = Cl, Br, I) in NH_2Ph contain part of the solute in the form of an almost undissociated solvate, (2) that the conductivity (Λ) depends entirely on the ionisation of the non-solvated salt, and (3) that the ionisable component obeys Kohlrausch's law, an expression showing the relationship existing between the several components of the solution is derived. Λ data previously recorded (A., 1939, I, 474) agree with the derived expression and enable the equilibrium consts. to be calc. In the solutions examined the solute is predominantly (~90%) in the non-conducting solvated form. F. L. U.

(A) Effect of association on the refractive index of liquid mixtures. Binary systems of quinoline with organic acids. (B) Refractive index of binary systems of amines and *iso*butyric acid. P. MATAVULJ. **(C) Effect of association on the refractive index of binary liquid mixtures of pyridine with organic acids. (D) Refractive index of liquid binary systems of amines with *iso*valeric acid.** P. MATAVULJ and J. HEUMANN (Bull. Soc. Chim. Yougoslav., 1939, **10**, 25—33, 35—42, 43—49, 51—56).—(A) Deviations of n from the additive rule are max. for approx. 1 : 1 quinoline–Me·$[CH_2]_n$·CO_2H (n = 1—8) mixtures, at 20° and 50°. The Δn–composition curves do not give evidence of compound formation, which is probably masked by association of the acid component.

(B) The Δn–composition curves suggest 1 : 2 mol. compounds in the systems $Pr^{\beta}CO_2H$ (I)–NH_2Ph or –C_5H_5N, and 1 : 1 compounds in the systems (I)–NHPhMe or –$NPhMe_2$. Ammonium salts are formed in the systems (I)–NH_2Pr^{a}, –$NHEt_2$, –piperidine, or –NEt_3; the ammonium salt formed with NEt_3 gives a mol. compound with (I).

(C) The Δn–composition curves of the systems C_5H_5N–$EtCO_2H$, –$PrCO_2H$, or –$BuCO_2H$ suggest 1 : 3 mol. compounds, at 20° and 50°. A similar effect is not observed with higher org. acids, probably owing to their association.

(D) The n–composition curves of the systems $Bu^{\beta}CO_2H$ (II)–NHPhMe, –$NPhMe_2$, and –NEt_3 suggest 2 : 1 compounds, whilst a 3 : 1 compound appears to be formed in the system (II)–C_5H_5N, and 1 : 1 compounds in the systems (II)–NH_2Pr, –$NHEt_2$, and –piperidine. No evidence of compound formation is found in the systems (II)–NH_2Ph, probably as a result of association of (II). R. T.

Measurements of surface tension and determination of molecular compounds of beryllium nitrate and alkali nitrates. R. CHAUVENET (Compt. rend., 1940, **210**, 250—252; cf. A., 1939, I, 143).—The existence in 0·53—2N. aq. solutions of compounds mBe$(NO_3)_2$,$n$$M^{I}NO_3$ with the following $m : n$ ratios is indicated by surface tension measurements: M^{I} = Na, 7 : 9; K, Rb, Cs, 1 : 1; NH_4, 2 : 3. A. J. E. W.

Ebullioscopic investigations on solutions of azides and cyanides in hydrogen fluoride. W. KLATT (Z. physikal. Chem., 1939, **185**, 306—312).—HN_3 and HCN are almost insol. in anhyd. liquid HF, and most azides and cyanides are decomposed by it, but AgN_3, HgN_6, and $Hg(CN)_2$ dissolve and can be recovered unchanged. The b.p. elevations of the solutions correspond with >1 mol. per mol. of salt, indicating formation of F′ ions and complex cations such as $(AgN_3H)^{\cdot}$ and $[Hg(CN)_2H]^{\cdot}$. F. J. G.

Degeneracy and dissociation constants. H. O. JENKINS (Nature, 1940, **145**, 149—150).—Linear relations exist between the complexity of degeneracy (defined in terms of the no., n, of possible resonating structures) and K for the series AcOH, CH_2Ph·CO_2H, and $CHPh_2$·CO_2H, and between log n and pK_B for NH_3, NH_2Ph, and $NHPh_2$. The val. of K predicted for CPh_3·CO_2H in H_2O is 25×10^{-5}; pK_B predicted for NPh_3 is zero. L. S. T.

Extent of dissociation of salts in water. IX. Calcium and barium salts of dicarboxylic acids. N. E. TOPP and C. W. DAVIES (J.C.S., 1940, 87—93).—Dissociation consts. for the Ca and Ba salts of a no. of dibasic org. acids are given. The Ba salts are always stronger than the Ca salts, and the salts of OH-acids are particularly weak. F. J. G.

Second dissociation constant of acids derived from phthalic acid. W. E. BERGER (Helv. Chim. Acta, 1940, **23**, 39—53).—Using catalytic and potentiometric methods, K_2 at 25° has been determined for 3- and 4-nitro- and 3 : 6-dichloro-phthalic and nitro- and bromo-terephthalic acids. The vals. agree well with those obtained conductometrically especially for the first two and last acids. C. R. H.

Hydrogen-ion activity and catalysis of ethyl diazoacetate by organic acids. M. DUBOUX and G. PIÈCE (Helv. Chim. Acta, 1940, **23**, 152—170).—The $H^{\cdot}$ activities of solutions of AcOH, BzOH, and o-OH·C_6H_4·CO_2H alone and in presence of the corresponding Na salt, of solutions of succinic, tartaric, malic, and fumaric acids, and of solutions of OH·CHPh·CO_2H + OH·CHPh·CO_2Na have been determined, and the rate of decomp. of $EtCO_2CHN_2$ in these solutions has been measured. For the pure acid solutions k/a_H (k = velocity coeff., a_H = $H^{\cdot}$ activity) is reasonably const. and is independent of the acid or its concn. The average val. is 37·0 at 25°. In acid–salt mixtures k/a_H is const. for a given acid but varies from 33·1 to 39·1 according to the strength of the acid. C. R. H.

Activity theory of non-electrolytes. I. General thermodynamic basis. II. Energy of reciprocal action and entropy of mixing. A. MUSIL (Österr. Chem.-Ztg., 1939, **42**, 371—381, 395—406).—I. Theoretical. The energy and entropy changes in binary liquid mixtures are related to the consts. of the solution function of the Duhem–Margules differential equation, as determined from v.p. measurements. By treating the partial v.p. and therefore the Margules const. as indicating the activity of the components, this relationship is developed into a general activity theory of binary non-electrolyte liquid mixtures.

II. The various stages of mol. interaction (orientation effects, cluster formation, solvation, and formation of stoicheiometric compounds) are discussed with particular reference to the physical properties and chemical constitution of the components. By application of activity relationships equations are developed to express the activity coeff., activities, chemical potentials, entropies, and other thermodynamic functions of the components of binary liquid mixtures. J. W. S.

Thermodynamic properties of solutions of amino-acids and related substances. IV. Effect of increasing dipolar distances on activities of aliphatic amino-acids in aqueous solution at 25°. E. R. B. SMITH and P. K. SMITH. **V. Activities of some hydroxy- and *N*-methylamino-acids and proline in aqueous solution at 25°.** P. K. SMITH and E. R. B. SMITH (J. Biol. Chem., 1940, **132**, 47—56, 57—64; cf. A., 1938, I, 31).—IV. Osmotic and activity coeffs. have been calc. from

isopiestic v.p. measurements of aq. solutions of β-alanine, *dl*-β-amino-butyric and -valeric acid, γ-aminobutyric acid, *dl*-γ-amino-*n*-valeric acid, and ε-aminohexoic acid. —Log g/c (g = osmotic coeff., c = concn.) decreases with increasing length of the C chain and increases with increasing dipolar distance. A similar variation is found with $-\log N_A/N_0$, where N_A and N_0 are the mol. fractions in EtOH and H_2O respectively. Approx. vals. of the salting-in and salting-out const. have been derived from the variation of $-\log g/c$ with ϵ_0/ϵ, the ratio of dielectric consts. of solvent and solution; this variation is, however, linear only in the case of α-NH_2-acids.

V. Osmotic and activity coeffs. have been calc. from isopiestic v.p. measurements of aq. solutions of *dl*-proline, *l*-hydroxyproline, *dl*-serine, *dl*-threonine, sarcosine, and betaine. The val. of g is lowered by the substitution of an OH in the hydrocarbon chain and raised by the attachment of a Me to the N instead of to the chain. D. F. R.

Benzene–toluene isopiestic liquid–vapour equilibrium data. F. TODD (Ind. Eng. Chem., 1940, **32**, 287—288).—The data of Rosanoff *et al.* (A., 1914, ii, 800) are recalc. using more recent v.p. data. F. J. G.

Solidification point curves of binary [fatty] acid mixtures.—See B., 1940, 222.

Binary system phenylhydrazine–*p*-chlorophenol. N. A. PUSHIN and D. M. DIMITRIJEVIĆ (Bull. Soc. Chim. Yougoslav., 1939, **10**, 17—24).—The fusion diagram consists of two sets of curves, corresponding with stable and metastable conditions, and suggests a 2 : 1, m.p. 33°, a 1 : 1, m.p. 27°, and a 1 : 2, m.p. 16°, *compound*, in addition to a compound of uncertain composition which appears to exist in the metastable region. R. T.

Formation of mixed crystals or molecular compounds from the binary systems of keto-derivatives of camphor. A. WATANABE (Proc. Imp. Acad. Tokyo, 1939, **15**, 349—352).—The existence of mixed crystals and mol. compounds in binary systems of *o*-, *p*-, 6-, 10-, and *trans*-π-ketocamphor has been established by *X*-ray and thermal analysis. The formation of mixed crystals is usually accompanied by an increase in stability. D. F. R.

Tie-lines in two-liquid-phase systems. A. V. BRANCKER, T. G. HUNTER, and A. W. NASH (Ind. Eng. Chem. [Anal.], 1940, **12**, 35—37).—A method for interpolating tie-line data which requires only two accurately determined tie-lines is described. Numerous systems to which the method is applicable are tabulated. L. S. T.

Tie-lines in ternary liquid systems. I. BACHMAN (Ind. Eng. Chem. [Anal.], 1940, **12**, 38—39).—A method that requires only two experimentally determined points and reduces tie-line curves to straight lines on rectangular co-ordinates is described. Interpolation of tie-line data is simple and rapid. L. S. T.

Salt hydrates and deuterates. II. Correlation of heat of dissociation and structure. J. BELL (J.C.S., 1940, 72—74; cf. A., 1937, I, 243).—Dissociation pressures at 20—40° are recorded for the following: $NiSO_4,7D_2O$; $NiSO_4,7H_2O$; $CoSO_4,7D_2O$; $ZnSO_4,7D_2O$; $ZnSO_4,7H_2O$; $CuCl_2,2D_2O$; $BaCl_2,2D_2O$; $KF,2D_2O$; $KF,2H_2O$; $D_2C_2O_4,2D_2O$; $H_2C_2O_4,2H_2O$. The following vals. of ρ_4^{20} are recorded: $H_2C_2O_4,2H_2O$, 1·650; $D_2C_2O_4,2D_2O$, 1·688; KH_2PO_4, 2·319; KD_2PO_4, 2·324; $CuSO_4,5H_2O$, 2·272; $CuSO_4,5D_2O$, 2·379; Li_2SO_4,H_2O, 2·051; Li_2SO_4,D_2O, 2·127; $CoSO_4,7H_2O$, 1·939; $CoSO_4,7D_2O$, 2·038; $CoCl_2,6H_2O$, 1·918; $CoCl_2,6D_2O$, 2·013; $SrCl_2,6H_2O$, 1·954; $SrCl_2,6D_2O$, 2·051. In general, the salt hydrates have higher dissociation pressures, lower heats of dissociation, and smaller mol. vol. than the deuterates, indicating simple covalent or van der Waals forces, but with $H_2C_2O_4,2H_2O$ and KH_2PO_4 replacement of H by D has the reverse effects, due to H bonding. F. J. G.

System trisodium phosphate–sodium carbonate–water. K. A. KOBE and A. LEIPPER (Ind. Eng. Chem., 1940, **32**, 198—203).—New data on the alkaline region of the system Na_2O–P_2O_5–H_2O at 25° are given. The marked effect of excess of alkali or acid on the solubility of Na_3PO_4, and the circumstance that it is never in equilibrium with a solid phase of the same composition, account for the discrepancies in earlier data. Solubility data at 0—100° for a solid phase of the composition $Na_3PO_4,\frac{1}{7}NaOH$ (I) and equilibrium data for the system (I)–Na_2CO_3–H_2O at 0—100° are given. There are neither mixed crystals nor double salts. F. J. G.

System silver sulphate–aluminium sulphate–water. J. A. ADDLESTONE, L. R. MARSH, and G. C. HALL (J. Physical Chem., 1940, **44**, 256—259).—Isotherms of the system Ag_2SO_4–$Al_2(SO_4)_3$–H_2O obtained at 0°, 25°, and 45° offer no evidence for the formation of Ag alum. C. R. H.

Determining composition of solid phases of quaternary systems in equilibrium. V. I. NIKOLAEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 556—558).—Theoretical. The application of Schreinemakers' method is described with reference to the aq. system $Na_2Cl_2 + MgSO_4 \rightleftharpoons Na_2SO_4 + MgCl_2$. O. D. S.

Action of pentols (pentanepentaols) on electrical conductivity of boric acid [solutions]. J. BÖESEKEN and J. M. FURNÉE (Rec. trav. chim., 1940, **59**, 97—104; cf. A., 1915, ii, 136; 1921, i, 843).—The effect of pentanepentaols in increasing the conductivity (κ) of aq. H_3BO_3 is intermediate between that of erythritol and that of the hexanehexaols. The increases (over the additive vals.) caused by 0·5M. solutions in 0·5M-H_3BO_3 are: adonitol $90·7 \times 10^{-6}$, arabitol $356·7 \times 10^{-6}$, xylitol (0·25M.) $418·0 \times 10^{-6}$ mho. The differences are attributed to the different spatial configurations; pairs of adjacent OH groups exert a much greater influence when situated as in *d*- or *l*-tartaric acid than when situated as in mesotartaric acid. Details of prep. of the pentaols is given. F. L. U.

Conductance of solutions of organo-substituted ammonium chlorides in liquid hydrogen sulphide. E. E. LINEKEN (Iowa State Coll. J. Sci., 1939, **14**, 60—63).—Mol. conductance measurements at various concns. on solutions of mono-, di-, tri-,

and tetra-methyl-, -ethyl-, and propyl-ammonium chlorides in pure liquid H_2S at const. temp. show that the solutions are conductors, and that increasing the size of the substituted NH_4 by changing the substituent from Me to Et to Pr somewhat increases the conductance. An unexplained exception is that in solutions more dil. than 0·0036M. $NHEt_3Cl$ shows higher mol. conductances than does $NHPr_3Cl$. Increasing the no. of substituents in the NH_4 markedly increases the conductance; the increase is especially notable on substituting the last H of the NH_4.

N. M. B.

Electrolysis of solid solutions of oxygen in metallic zirconium. J. H. DE BOER and J. D. FAST (Rec. trav. chim., 1940, **59**, 161—167; cf. A., 1936, 1056).—Measurements of the lattice consts. and of the *d* of Zr containing varying amounts of O up to 30 at.-% show that the O atoms are present in solid solution. At high temp. (1600—1800°) an electric field causes the O to move through the lattice as a negative ion; the [O] thus increases at the anode end, and with it the electrical resistance.

F. L. U.

Quasi-reversible conduction and galvanic cells with liquid–liquid junctions. F. O. KOENIG (J. Physical Chem., 1940, **44**, 101—135).—Theoretical. The defects of the present thermodynamic theory are pointed out, and the assumptions and definitions underlying the theory are revised, account being taken of arbitrary concn. gradients and gravitational potential. A general condition for "quasi-reversible conduction" is derived which permits the deduction of the thermodynamic laws for cells with liquid–liquid junctions. J. W. S.

Electrode polarisation. III. Rate of growth of polarisation potentials. A. HICKLING (Trans. Faraday Soc., 1940, **36**, 364—369).—Arrangements are described by which a steady image on the screen of a cathode-ray oscillograph shows directly the variation of potential with quantity of electricity passed. The growth of overvoltage in the deposition of Ni has been studied; the potential varies linearly with quantity of electricity passed up to the point at which deposition occurs, suggesting that the effect is due to slow discharge of $Ni^{\cdot\cdot}$ ions. F. J. G.

Capacity of electrodes in dilute solutions. M. A. PROSKURNIN and M. A. VORSINA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 915—917).—The study of the capacity of metallic electrodes is important in determining the structure of the electrical double layer, and an electric method has been devised using a Hg electrode with a.c. of 1 cycle per sec. with which measurements are possible down to 0·001N. for salt solutions and 0·0001N. for aq. HCl.

W. R. A.

Capacity of double layer of mercury electrode in dilute solutions of hydrochloric acid and of potassium chloride. M. A. VORSINA and A. N. FRUMKIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 918—921).—The method described (see preceding abstract) has been used to plot the capacity curves of a Hg electrode in dil. KCl (1, 10^{-1}, 10^{-2}, 10^{-3}N.) and HCl (10^{-3}, 10^{-4}N.). The curve of 0·1N-KCl consists of two almost horizontal branches which correspond with a double layer formed of anions and cations respectively, and a connecting branch with intermediate capacity vals. At high positive or negative surface charges the capacity val. increases owing to the deformation of ions. This curve does not indicate a diffuse structure. The data are compared with the requirements of Stern's theory.

W. R. A.

Determination of mobilities and dissociation constants by means of conductivity titrations. (MISS) J. P. PHILPOT, E. C. RHODES, and C. W. DAVIES (J.C.S., 1940, 84—87).—Examples are given of the calculation of mobilities and dissociation consts. from conductivity-titration curves. F. J. G.

Polarographic studies of the denaturation and proteolytic cleavage of proteins.—See A., 1940, III, 259.

Induction period in thermal explosions. D. A. FRANK-KAMENETZKY (J. Chem. Physics, 1940, **8**, 125—126).—Reasons are given which show that the calculation of the induction period cannot be regarded as an appropriate method for comparing the theory of thermal explosions with experiment and, in particular, for computing the thermal effect of explosive reactions. Existing data (*e.g.*, A., 1936, 33; 1937, I, 190; 1939, I, 568) are considered in the light of these reasons and it is concluded that the only accurate method for comparing the theory of thermal explosions with experimental data is the calculation of the thermal explosion limit using the laws of thermal transfer (A., 1939, I, 614). W. R. A.

Exchange reactions between deuterium and hydrogen halides. I. Hydrogen chloride. H. STEINER and E. K. RIDEAL. **II. Hydrogen bromide.** H. STEINER (Proc. Roy. Soc., 1939, **A**, **173**, 503—530, 531—542).—I. The exchange reactions between $D_2 + HCl$, $H_2 + DCl$, and the ortho–para-H_2 conversion catalysed by HCl, were studied. The reaction is bimol. of the type $D_2 + HCl = HD + DCl$ together with an at. chain reaction initiated by thermally decomposed atoms.

II. A study of the analogous reactions involving Br in place of Cl shows that no bimol. reaction takes place, the exchange being due to at. chain reactions. Vals. of the rate of the reaction $H + HBr = H_2 + Br$ are given and discussed. G. D. P.

Reaction of atomic hydrogen with azomethane. H. HENKIN and H. A. TAYLOR (J. Chem. Physics, 1940, **8**, 1—7).—The reaction between at. H and $(NMe\colon)_2$ at 27° involves the addition of 2 H to the N double linking to produce $(NHMe)_2$ by a mechanism with an activation energy of $\not>$3—4 kg.-cal. per mol. Gaseous products are absent, indicating the non-rupture of $(NMe\colon)_2$. At 110°, in addition to the $(NHMe)_2$, rupture of the C–N linking in $(NMe\colon)_2$ and of the N–N linking in the hydrazine gives CH_4 and C_2H_6, and NH_2Me respectively. The energy of activation of each type of rupture is ~8 kg.-cal. per mol. At 195° an additional reaction involves the association of Me radicals with $(NMe\colon)_2$, producing $(NMe_2)_2$ and NMe_2·NHMe. W. R. A.

Kinetics of thermal decomposition of fully deuterated diethyl ether. J. G. DAVOUD and

C. N. HINSHELWOOD (Proc. Roy. Soc., 1940, **A, 174**, 50—56).—The reaction was studied at 550°, its course being followed by observation of the pressure changes. The apparent chain length is determined by comparison of the rate of the reaction uninhibited and inhibited by NO_2. Activation energies are deduced and the results are discussed and compared with those obtained from the H-ether (cf. A., 1939, I, 375). G. D. P.

Emission spectrum of hydrocarbon flames. E. C. W. SMITH (Proc. Roy. Soc., 1940, **A, 174**, 110—125).—A spectroscopic examination of the effect of pressure on the stationary flames of C_2H_4 and C_2H_4–H_2 mixtures burning in air was made. The explosion flames of C_2H_4–O_2 and of C_3H_8–O_2 mixtures were also investigated and the explosion limits of these mixtures determined. The mechanism of C deposition and of green flames in explosion processes is discussed; current views are inadequate to explain the results obtained. G. D. P.

Mechanism by which "cool" flames give rise to "normal" flames. III. Physical characteristics of the two-stage process of ignition of ether–oxygen mixtures. IV. Chemical character of the "blue" flame initiated in the "cool" flame products of ether–oxygen mixtures. M. MACCORMAC and D. T. A. TOWNEND (J.C.S., 1940, 143—150, 151—156).—III. The combustion of Et_2O–O_2 and Et_2O–air mixtures with the ignition depending on "cool" flame formation has been studied, the "cool" flame being induced either spontaneously at high temp. and low pressures or artificially by means of a heated wire at room temp. and high pressure. The ignition in both cases is due to the initiation of a second flame, the "blue" flame, in the "cool" flame products; this flame is distinguishable from the "cool" flame by a marked increase in the vol. of its products. In narrow tubes with sufficient O_2 the "blue" flame may overtake the "cool" flame and extinguish it, giving a normal flame which is not self-propagating and dies out; in wider tubes the normal flame may degenerate into a "cool" flame, thus giving an oscillatory propagation. When const. pressure is maintained and the products of the "blue" flame are released, the "blue" flame is not self-propagating but is always preceded by a "cool" flame, the distance between the two being a function of the pressure and the mixture composition; both flames differ from one another and from normal flames.

IV. A new method for the study of the chemical characteristics of two-stage inflammation of higher hydrocarbons and their derivatives is described. A cooled reaction tube is incorporated in a flow system. The method has been applied to an examination of the differences between the "cool" and "blue" flames of Et_2O; the former produces aldehydes and peroxides which, together with much of the rest of the Et_2O, are decomposed in the latter. The "blue" flame is thus essentially a zone of luminous decomp. in which heat is evolved owing to a series of exothermic reactions possibly brought about by the interaction of peroxides with one another or with aldehyde, but in presence of excess of O_2 the spontaneous decomp. of certain of the "cool" flame products leads to normal ignition. The flame temp. have also been measured, the "cool" flame being at ~320—395° and the "blue" at ~460—510°, depending on the pressure. J. L. E.

Mechanism of combustion and detonation.—See B., 1940, 185.

Exchange reactions of the nuclear hydrogen atoms in aniline hydrochloride in aqueous solution. I. Reaction in acid and neutral solution. M. KOIZUMI (Bull. Chem. Soc. Japan, 1939, **14**, 530—539).—The exchange reaction in neutral and strongly acid solutions has been kinetically investigated by the method of Titani and Koizumi (A., 1938, II, 483). The velocity coeff. shows that the reaction is bimol. over a wide range of concn. of NH_2Ph,HCl and acid. The fundamental equation is therefore $NH_2Ph + H_2DO^{\cdot} \rightarrow C_6H_4D{\cdot}NH_2 + H_3O^{\cdot}$. T. H. G.

Kinetics of the reaction between ethylene glycol and lead tetra-acetate. R. P. BELL, J. G. R. STURROCK, and R. L. ST. D. WHITEHEAD (J.C.S., 1940, 82—84).—The reaction in AcOH is unimol. with respect to each reactant, and the velocity coeff. is given by $k = 1{\cdot}95 \times 10^{14}e^{-20{,}900/RT}$ between 18° and 45°. The steric factor ~1 implies a radical mechanism. F. J. G.

Bromine ion as brominating agent. E. SCHILOV and N. KANIAEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 890—892).—The effect of p_H on the bromination of anisole-*m*-sulphonic acid (A) by HOBr at 0° is studied. The equation $d[HOBr]/dt = k_2[A][HOBr]$ (I) holds in slightly alkaline solution. Under conditions of increasing acidity due to HNO_3 or H_2SO_4 when $[A] = 3{\cdot}4$ to $10{\cdot}8$ and $[HOBr] = 1{\cdot}9$ to $4{\cdot}2$ m-mols. per l., k_2 increases in val., but $k_2/[H^{\cdot}]$ is approx. const. (k_1), which means that the reaction velocity $\propto p_H$. Since (I) can be written $d[HOBr]/dt = k_1[A][HOBr][H^{\cdot}]$, it follows that bromination probably proceeds through the effect of Br′. The sp. conductance of HNO_3 diluted with H_2O or HOBr is the same, which indicates that the [Br′] responsible for the reaction is very small. If the p_H of the reaction mixture is altered by adding HCl or HBr, k_2 is increased because of the presence of Br and BrCl. J. L. D.

Range of validity of the Arrhenius equation for reactions in solution. W. HÜCKEL, I. SCHNEIDER, and W. DOLL (Z. physikal. Chem., 1939, **185**, 313—320).—Departures from the Arrhenius equation occur below 60° in the saponification of *cyclo*hexyl phthalate (I) with KOH and of *cis*-*o*-methyl*cyclo*hexyl phthalate (II) with NaOH, but not in the saponification of (I) and of *trans*-(II) with NaOH. The effect may be due to the presence of colloidal material. F. J. G.

Velocity of hydrolysis of some aliphatic and aromatic nitriles. D. KARVÉ and D. V. GHARPURE (J. Univ. Bombay, 1939, [ii], **8**, Part 3, 139—159).—Velocities of hydrolysis with H_2SO_4 are recorded for RCN (R = Me, Et, Pr^a, Bu^a, Bu$^\beta$, CH_2Ph, Ph, *o*-, *m*-, and *p*-C_6H_4Me, *p*-C_6H_4Cl, and *p*-C_6H_4Br). For the aromatic nitriles hydrolysis proceeds easily up to $R{\cdot}CO{\cdot}NH_2$, the quantity of NH_4 salt being small. *o*-Me offers considerable steric hindrance. *p*- is hydrolysed more rapidly than *m*-$C_6H_4Me{\cdot}CN$, *p*-C_6H_4Cl than

p-$C_6H_4Br·CN$. For the aliphatic nitriles including $CH_2Ph·CN$ hydrolysis to the NH_4 salt is easier than the first stage. F. R. G.

Decomposition of thionyldiacetic acid in acid aqueous solution. E. LARSSON (Svensk Kem. Tidskr., 1940, **52**, 9—15).—The decomp. $SO(CH_2·CO_2H)_2 \rightarrow CHO·CO_2H$ (I) + $SH·CH_2·CO_2H$ (II) has been studied in acid aq. solution at 75°. The reaction is unimol., k decreasing with time owing to the secondary reaction: (I) + 2(II) $\rightarrow H_2O$ + $CH(S·CH_2·CO_2H)_2·CH·CO_2H$. The initial val. k_0 = 0·029[acid], for HCl, HBr, and $HClO_4$. If $HgCl_2$ is added to remove (II) as mercaptide and so prevent the secondary reaction, k remains const. (= k_0) unless the acid concn. is low, when it increases with time, owing to the HCl liberated by mercaptide formation. Direct titration of the reaction mixture with I (the above vals. were obtained by addition of excess and back titration) gives a lower end-point, which increases with time. Prep. of possible intermediates in the decomp. showed that this is due to $CO_2H·CH(OH)·S·CH_2·CO_2H$, which reacts only slowly with I in acid, but rapidly in alkaline, solution. M. H. M. A.

Primary stages in the formation of black platinum. D. L. BERDITSCHEVSKAJA and P. D. DANKOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 545—548).—An induction period in the pptn. of Pt by CH_2O from alkaline solutions has been observed. The period is increased by lowering of the concns. of the solutions, lowering of temp., and by removal of dust. O. D. S.

Action of gas explosion on solid explosives. K. K. ANDREEV and V. P. MASLOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 195—197).—The hypothesis that a certain localisation of the initial chain reaction centres of detonation is necessary for detonation leads to the probability of the continuation of the chain becoming unity, finite chains becoming infinite and the reaction becoming self-propagating owing to interaction of neighbouring chains forming the group centres. The condition that the probability of detonation being established will be unity when any agent acts on the surface of an explosive requires that the surface density of the centres of localisation created should be > a crit. val. Hence the action of particles with high energies sufficient to initiate chains should not cause an explosion if their concn. is low. Calculations on this basis suggest that the detonating ability of H_2–O_2 mixtures should be observed only at ~15 atm. Experiments showed that at low pressures (~1 atm.) H_2–O_2 mixtures, exploded by a crystal of PbN_3 detonated by fusing a wire, did not cause charges of $C_6H_2(NO_2)_3·OH$, glycerol tri- or erythritol tetra-nitrate to explode but that explosions did occur at pressures ~20 atm. F. H.

Periods of latent crystallisation and equation for rate of formation of crystal nuclei. M. L. TSCHEPELEVETZKI (J. Phys. Chem. Russ., 1939, **13**, 561—571).—The crystallisation of Ca phosphates from supersaturated solutions in aq. H_3PO_4 and of other salts has been followed nephelometrically. The period of latent crystallisation, *i.e.*, the time required for the nuclei to reach certain standard dimensions, serves as a measure of the rate of formation of nuclei, v, and of their rate of growth. If allowance is made for the η of the solution, the equation connecting v with the degree of supersaturation and the temp. is analogous to that for the formation of nuclei from a vapour, and may be used to calculate the sp. surface energy of the crystals at the solid–liquid interface. R. C.

Statistical fluctuations in autocatalytic reactions. M. DELBRÜCK (J. Chem. Physics, 1940, **8**, 120—124).—Theoretical. The statistical fluctuations of a simple autocatalytic reaction mechanism approach a const. limiting val. when the amount of reaction product is $\gg$ the amount which initiates the reaction. W. R. A.

Kinetics of the thermal decomposition of the lower paraffins. V. Nitric oxide-inhibited decomposition of n-butane. E. W. R. STEACIE and H. O. FOLKINS (Canad. J. Res., 1940, **18**, **B**, 1—11; cf. A., 1939, I, 422).—The effect of NO in inhibiting the thermal decomp. of n-C_4H_{10} in the temp. range 500—550° decreases with increasing [C_4H_{10}] and with rising temp. The normal and the inhibited reactions have the same activation energy (57—58 kg.-cal.) at high pressures and give rise to the same products. It is concluded that free radical processes, involving relatively short chains, predominate. F. J. G.

Thermal polymerisation of styrene and its inhibition. S. G. FOORD (J.C.S., 1940, 48—56).—The effects of a no. of org. substances in inhibiting (*i.e.*, producing a long induction period) or retarding (*i.e.*, diminishing the max. rate) the polymerisation of styrene have been investigated. Quinonoid, NH_2- and NO-compounds are usually inhibitors rather than retarders, whilst phenols are retarders rather than inhibitors. Detailed results for the inhibition by benzoquinone and phenanthraquinone are given. The length of the induction period $\propto$ concn. of inhibitor. This implies that the inhibition involves a reaction between inhibitor and primary active mols., which is unimol. with respect to the former. On this view the length of the induction period is a measure of the rate of the primary activation, and this consideration enables the activation energy to be calc. as 28,000 g.-cal., and the mean mol. wt. of the 120° polymeride as ~20,000. F. J. G.

Influence of acidity on catalytic exchange of hydrogen and water. A. R. BENNETT and M. POLANYI (Trans. Faraday Soc., 1940, **36**, 377—381; cf. A., 1936, 1213).—It is shown, by the use of depoisoned alkali in the absence of air, that the retarding effect of alkali on the rate of exchange is not an accidental poisoning effect. The change from 0·1N-HCl to 0·1N-NaOH produces a 4—12-fold reduction in rate. F. J. G.

Catalytic hydration of carbon dioxide. M. KIESE and A. B. HASTINGS (J. Biol. Chem., 1940, **132**, 267—280).—The velocity coeffs. for the hydration of CO_2 according to the reactions $H_2O + CO_2 \rightleftharpoons H_2CO_3$ and $CO_2 + OH' \rightleftharpoons HCO_3'$ have been measured manometrically. Br, HOBr, Cl_2, and HOCl have a strong catalytic effect, especially in the alkaline

range. Br is stronger than Cl_2. I, HOI, the halides, halogenates, and perhalogenates have little catalytic effect. SO_3'' and SeO_3'' are weaker than Cl_2; their optimum activity is at p_H between 7 and 8. Wt. for wt. carbonic anhydrase is at least 10^3 times as active as Br. D. F. R.

Stabilisation of hydrogen peroxide.—See B., 1940, 242.

Mechanism underlying acceleration and retardation of autoxidation of hydrocarbons. I. Influence of accelerators and inhibitors of autoxidation on the decomposition of organic peroxides. II. Influence of accelerators and inhibitors of autoxidation on the formation of organic peroxides. K. I. IVANOV, V. K. SAVINOVA, and E. G. MICHAILOVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 34—39, 40—42).—I. The kinetics of the decomp. of tetrahydronaphthyl H peroxide (I) and tetrahydronaphthyl $OH·CH_2$ peroxide (II) in solution in decalin and tetralin containing 4 mol.-% of (I) and (II) at 75—150° have been investigated. The rate of decomp. of (II) is > that of (I) at the same temp., and the rate varies with the solvent. Substances known to be negative catalysts of the autoxidation in the liquid phase [o- and m-$C_6H_4(OH)_2$, $C_{10}H_7·OH$, p-$OH·C_6H_4·NHPh$, α-$C_{10}H_7·NH_2$, $NHPh·C_{10}H_7$-β] produce no definite effect on the rate of decomp. Positive catalysts of autoxidation accelerate the decomp. of (I) but have no effect on that of (II). $PbEt_4$ strongly accelerates the decomp. of (I), but inhibits that of (II). The results do not agree with those of Yamada (A., 1937, I, 316; II, 56).

II. Substances which inhibit the autoxidation of liquid hydrocarbons inhibit very strongly the formation of (I). Naphthenates of Fe and Mn, which catalyse the autoxidation of the hydrocarbons, also catalyse the formation of (I). $PbEt_4$ inhibits the formation of (I) but octyl nitrite accelerates it. A. J. M.

Induced oxidation in the autoxidation of xanthine. W. P. JORISSEN and (MISS) A. C. B. DEKKING (Natuurwetensch. Tijds., 1939, **21**, 196—198).—In alkaline media, xanthine (I) absorbs 1 mol. of O_2 at 37°. 2 mols. of O_2 are absorbed in presence of As_2O_3 or CoO whilst in presence of MnO_2, CuO, or V_2O_5 the absorption of 2 mols. of O_2 is followed by liberation of all the N in (I) as N_2. S. C.

Mixed redox catalysts. I. Mechanism of activation of iron by copper. L. KULBERG and E. MATENKO (J. Phys. Chem. Russ., 1939, **13**, 600—604).—In the oxidation of benzidine, o-tolidine, and m-$C_6H_4(NH_2)_2$ by H_2O_2 catalysed by Fe^{II} salts, Cu salts act as promoters, apparently by regenerating the active form of Fe. R. C.

Activation energy of urea hydrolysis catalysed by soya-bean urease.—See A., 1940, III, 260.

Kinetics of reactions in heterogeneous systems. IV. Hydrolysis of benzyl acetate, butyl acetate, and *iso*amyl acetate by hydrochloric acid. D. KARVÉ and V. L. MEHENDALE (J. Univ. Bombay, 1939, [ii], **8**, Part 3, 160—169).—The velocities of hydrolysis at 30° are recorded. The reaction is heterogeneous and the val. of k increases gradually owing to the catalytic influence of AcOH liberated. F. R. G.

Catalytic oxidation of hydrogen on platinum. Chemiluminescence and ionisation. R. POTVIN and C. OUELLET (J. Physical Chem., 1940, **44**, 235—246).—It was not possible to detect ultra-violet radiation emitted by the reaction $H_2+0·5O_2 \rightarrow H_2O$ catalysed by a Pt filament at 10 mm. Hg over the range 80—170°. If such radiation be emitted it must be <1 photon per 10^8 reacting mols. Both negative and positive electricity are emitted from the filament although the former is possibly a localised thermionic effect. The latter sets in at 340° and appears to be connected with the presence of O on the Pt surface as a result of imperfect removal during preheating. C. R. H.

Catalysis by metallised bentonites. G. BROUGHTON (J. Physical Chem., 1940, **44**, 180—184).—Na, Ca, Fe, and Ni ions combined with acid bentonite were used as catalysts for the decomp. of H_2O_2, polymerisation of pinene, and thermal decomp. of $Pr^{\beta}OH$. The action of the ions varies with the reaction and in some cases the ions lower the activity of the bentonite. The activities of the ions and of the bentonite appear to be considerably independent of each other. C. R. H.

High-temperature oxidation of carbon monoxide catalysed by quartz surface. Y. KONDO and O. TOYAMA (Rev. Phys. Chem. Japan, 1939, **13**, 166—175).—The rate of oxidation of CO over the range 578—647° is considerably reduced in presence of H_2O. This differs from the observation reported by Hinshelwood (cf. A., 1932, 916; 1933, 30). The mechanism of the reaction in presence and in absence of H_2O appears to be the same, viz., a bimol. interaction of CO and O_2 adsorbed on the walls of the reaction vessel. The retarding effect of H_2O and, to a smaller extent, CO is attributed to strong preferential adsorption on the walls. C. R. H.

Activated carbon as a catalyst in certain oxidation–reduction reactions. E. C. LARSEN and J. H. WALTON (J. Physical Chem., 1940, **44**, 70—85).—The catalytic decomp. of H_2O_2 is most rapid in contact with C activated at 825—875°, and, of the materials tested, gelatin yielded the most active C. The temp. coeff. of the decomp. is 1·90, 1·97, and 2·03 for the temp. ranges 15—25°, 20—30°, and 25—35°, respectively. The decomp. decreases rapidly at p_H <~3·5. Small amounts of $Fe^{\cdot\cdot\cdot}$ or $Cu^{\cdot\cdot}$ reduce the activity of the C, probably owing to preferential adsorption on the C, but larger additions increase the rate of decomp. The activity of the C is decreased rapidly by the combined action of H_2O and O_2, *e.g.*, during the decomp. reaction. This decay in activity is discussed from the viewpoint of surface oxides of C and the chain mechanism of the H_2O_2 decomp. C activated at ~575° is most active as catalyst for the autoxidation of $SnCl_2$, and the efficiency decreases rapidly for activation temp. >650° or <450°. The autoxidation of K urate is catalysed most efficiently by C activated at higher temp., but there is no range of pronounced activity. Both autoxidation reactions are of zero order and in

neither case does the activity of the C decrease on use. J. W. S.

Decomposition of ammonia by iron catalyst. K. Seya (Rev. Phys. Chem. Japan, 1939, **13**, 137—144).—The decomp. of NH_3 by reduced Fe at 390—430° has been investigated. The activity of the catalyst is reduced by continuous use but it can be recovered by a fresh reduction. The reaction appears to be in three stages, a zero-order reaction preceded and followed by a first-order reaction of retarded form. C. R. H.

Decomposition of ammonia by iron catalyst mixed with Al_2O_3 and K_2O. R. Kiyama (Rev. Phys. Chem. Japan, 1939, **13**, 125—136).—With catalysts of the Fe_3O_4–Al_2O_3–K_2O system an increased proportion of Al_2O_3 retards and of K_2O increases the rate of decomp. of NH_3 at 440°. Admixture of N_2 with NH_3 has no effect on the decomp. of the latter, but H_2 and CO retard decomp. The activity of the catalysts is discussed in connexion with the influence of Al_2O_3 and K_2O on the reduction of Fe_3O_4. From the application of Langmuir's formula to some supposed kinds of active parts, it is shown that decomp. proceeds in two stages, a first-order reaction of retarded form followed by a zero-order reaction. C. R. H.

Catalytic oxidation of ammonia at low pressures on platinum and alloys of platinum with rhodium and ruthenium. W. Krauss and H. Schuleit (Z. physikal. Chem., 1939, **B**, **45**, 1—18; cf. A., 1938, I, 317).—The catalytic oxidation of NH_3 at 1250° on Pt surfaces shows an induction period during which the yield of NH_2OH increases whilst the yield of HNO_2 decreases. At surfaces of Pt–Rh–Ru alloy (Rh 1, Ru 2%), however, the yield of NH_2OH decreases and the yield of HNO_2 increases during the induction period. The relative yields depend, therefore, on the time for which the surface has been used, but the initial behaviour is restored by treating the surface with O_2. The induction period is attributed to a change in the period of adhesion of the NH_2OH on the Pt during its loss of O_2, thereby causing a change in the velocity of the reaction $NH_2OH + O_2 = HNO_2 + H_2O$. No induction period is observed with the reaction at surfaces of Pt–Rh alloys (1, 5, or 10% Rh). $\sim$50% of the NH_3 is converted into useful products. The formation of N_2 is attributed to the reaction $NH_2OH + O_2 = HNO_2 + H_2O$. J. W. S.

Catalytic dehydrogenation of paraffins to olefines.—See B., 1940, 190.

Catalytic hydrogenation-polymerisation of acetylene.—See B., 1940, 190.

Mechanism of catalytic action of vanadium oxides in conversion of methyl alcohol into formaldehyde.—See B., 1940, 190.

Electrochemical investigation of effect of organic oxidising agents on corrosion of metals in acid media. I. Oknin (J. Phys. Chem. Russ., 1939, **13**, 631—645).—The amount of corrosion, *m*, of Fe, cast Fe, and Pb in acid media containing NO_2-compounds and benzoquinone, the potentials of the metals, *E*, and the oxidation potential, E_0, of H on Pt in the corroding medium, the amount of H formed, *v*, and the electrical conductivities of the medium and the system metal|medium|metal have been determined. The results show that these org. substances accelerate corrosion by depressing the cathodic overvoltage of the micro-elements by oxidising the H separating there. *E*, *m*, and *v* are determined by E_0, which is therefore an index of the corrosive action of a medium. The effect of the H liberated on the cathodic resistance of the micro-elements is discussed. R. C.

Electrolytic deposition of silver from thiosulphate solutions.—See B., 1940, 214.

Gas cell; mechanism of the electrolysis of water; polarisation of cells. V. Karpen (Compt. rend., 1939, **209**, 988—990).—Application of the electron concn. (*C*) concept (A., 1939, I, 567, 613) to the Grove gas cell permits the energies of the reactions $4OH' \rightleftharpoons 2H_2O + O_2 + 4e$ and $2H^{\cdot} + 2e \rightleftharpoons H_2$ to be deduced from the heat effects at the electrodes and their temp. coeffs. The depolariser in a Leclanché cell is involved in the primary electrode process, as the O reduces *C* in the catholyte and increases the cathode potential. A. J. E. W.

Preparation of thin films of uranium and thorium by cathode sputtering. C. C. Van Voorhis (Rev. Sci. Instr., 1940, **11**, 77).—Working details are given. F. J. G.

Threshold potentials and reactivity under electrical discharge. S. S. Joshi (Current Sci., 1939, **8**, 548—549).—In reaction kinetics under electrical discharge, a min. potential (the threshold potential V_m) has to be exceeded to initiate the change in a given reactant, which may be pure or a mixture. For most substances, at V_m there is a sudden change (usually an increase) in the current through the system, with dissipation of the wattage. V_m is characteristic both of the reaction and of the nature of the material. The vals. of V_m of pure substances are identical with, or related to, the Paschen potentials. The determination of V_m throws light on the mechanism of complex chemical reactions, especially consecutive chemical reactions, and this has been applied to the study of the decomp. of NO by 5000 v. at two initial pressures, by measuring V_m at intervals of time. The curves are similar to the concn.–time curves characteristic of the intermediate compounds in consecutive reactions. This, together with the fact that admixture of traces of a component with a large electron affinity increases V_m, suggests the intermediate formation of NO_2, a deduction which has been fully confirmed by direct optical and analytical examination of the decomp. mixture at intermediate stages. V_m measurements are very sensitive to change, when a discharge reaction is produced under another restraint, *e.g.*, irradiation, magnetic field, alteration in temp., etc. Further, in quasi-chemical changes, *e.g.*, the induction of latent images on a photographic plate, activation of N_2, its deactivation, or spectral shift in the afterglow, V_m is the chief determinant of their inception and time rate. W. R. A.

Electrolysis in the glow discharge. Tetrapotassium peroxydiphosphate. F. Fichter and

K. KESTENHOLZ (Helv. Chim. Acta, 1940, **23**, 209—211).—The electrochemical oxidation of NaOAc, $C_5H_{11}\cdot CO_2K$, and $CO_2Et\cdot CH_2\cdot CO_2K$ in the glow discharge did not lead to hydrocarbon or diester synthesis. Similar electrolysis of a solution of KH_2PO_4 in presence of KOH, KF, and a trace of K_2CrO_4 led to $\sim$10% yield of $K_4P_2O_8$. C. R. H.

Latent image. J. E. DE LANGHE (Natuurwetensch. Tijds., 1939, **21**, 189—195).—Various theories are discussed. The connexion between the formation of Ag nuclei and the occurrence of weak spots bridges the gap between the Ag nucleus theory and the adsorption theory, both of which are necessary for elucidating the formation of the latent image and the mechanism of development. S. C.

Mechanism of photographic development. II. Development by quinol. T. H. JAMES (J. Physical Chem., 1940, **44**, 42—57; cf. A., 1939, I, 425).—Over the p_H range 8·0—8·9, maintained by $Na_2B_4O_7$–H_3BO_3 buffers, and in the absence of Na_2SO_3 and O_2, the rate of development (v) of AgBr emulsions by quinol $\propto [C_6H_4(OH)_2]^{0.5} \times [OH']$. Addition of benzoquinone (I) increases v owing to an effect, probably produced by a decomp. product, on the electrical double layer. (I) also attacks development centres, causing a decrease in the no. of grains developed for a given exposure. The results support the view that the active developing reagent is the $C_6H_4O_2''$ ion and that reduction occurs heterogeneously at the Ag–AgBr interface. Comparative vals. are given for v, the rate of autoxidation, and the rate of the Ag-catalysed reaction of $Ag^{\cdot}$ with a series of derivatives of quinol. J. W. S.

High-temperature photolysis of acetaldehyde. D. C. GRAHAME and G. K. ROLLEFSON (J. Chem. Physics, 1940, **8**, 98—105).—The photolysis of MeCHO vapour at 96—350° by 3130 A. and 2652 A. and at 60—300° by 3303 A. Hg radiation has been investigated. The mechanism suggested to account for the photolysis [almost identical with that proposed by Rice and Herzfeld (A., 1934, 369) for the thermal decomp. of MeCHO] is: (i) MeCHO + $h\nu \rightarrow CH_4$ + CO, (ii) MeCHO + $h\nu \rightarrow$ Me + CHO, (iii) Me + MeCHO $\rightarrow CH_4$ + Ac, (iv) Ac $\rightarrow$ Me + CO, (v) CHO $\rightarrow$ CO + H, (vi) H + MeCHO $\rightarrow$ H + Ac, (vii) Me + Me $\rightarrow C_2H_6$. The heat of activation of the over-all reaction is 8.6 ± 0.3 kg.-cal. and hence the energy of the C–C linking in MeCHO is 75 kg.-cal. By investigating the photolysis of $COMe_2$–MeCHO mixtures at 200° and 300° it is concluded that the yield of free radicals in MeCHO is, at 3130 A., slightly $>$ and, at 2652 A., slightly $<$ that in $COMe_2$ and that both Me and HCO radicals induce decomp. of MeCHO. No afterglow was observed in $COMe_2$ or MeCHO vapour 0·0025 sec. after irradiation with 3130 A. and it is concluded either that the fluorescence of $COMe_2$ and MeCHO is not due to recombination of Ac radicals (*i.e.*, to activated Ac_2) or that the life time of Ac radicals is 0·0025 sec. Irradiation with 2652 A. gives rise to a very weak fluorescence which cannot be satisfactorily explained. W. R. A.

Photochemical decomposition of cystine in wool.—See B., 1940, 194.

Effect of light on erythrosin and tetrabromofluorescein.—See B., 1940, 193.

Influence of monochromatic light on action of enzymes. XXVI—XXIX. Ultra-violet light. XXX—XXXIII. Infra-red rays.—See A., 1940, III, 342.

Formation of protective crust on sodium chloride on its dissolving in sodium sulphate solutions. A. V. NIKOLAEV and A. G. TSCHELISCHTSCHEVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 895—898).—When a cube of NaCl is added to fused Na_2SO_4 a protective, thenardite crust is formed on the NaCl, consisting of 56·17% of Na_2SO_4, which stops dissolution. Powdered NaCl dissolves readily, but only if it is added to the Na_2SO_4, and not vice versa. A mechanism of the formation of the crust is proposed on the basis of the formation of a film of saturated solution at the NaCl surface, which also explains the influence of the order of addition. W. R. A.

Growth, orientation, and preparation of the surface of single crystals of copper. A. T. GWATHMEY and A. F. BENTON (J. Physical Chem., 1940, **44**, 35—42).—Single Cu crystals 0·625 in. in diameter and 5 in. long have been prepared in a vac. furnace, using a modified form of the Bridgman method. The orientation is determined by etching in a solution of $AgNO_3$ (10 g. per l.) containing conc. HNO_3 (350 c.c. per l.) or of $(NH_4)_2S_2O_8$ (100 g. per l.) containing conc. aq. NH_3 (350 c.c. per l.). Each of these solutions develops the (111)-planes, whereas a solution of $CuCl_2$ (40 g.) in conc. HCl (1 l.) develops the (100)-planes. The crystal is cut by sawing parallel to any desired crystal plane and can be polished mechanically or by the electrolytic method. The latter has the advantage of removing any strained or amorphous layers in the surface. J. W. S.

Formation of the silver mirror. J. LOISELEUR (Compt. rend., 1939, **209**, 993—994).—Ag atoms deposited on reduction of Ag^I solutions tend to form aggregates which eventually become micelles. The potential of each particle falls rapidly during formation of the micelle, and if the small negative potential of a neighbouring glass surface is reached the particle is deposited by flocculation. The charge on the surface remains const., and the process can continue indefinitely. $Sn(OH)_2$ increases the negative charge on the surface and favours deposition of Ag; in presence of $Al^{\cdots}$ the charge becomes positive and formation of a mirror is prevented. A. J. E. W.

Precipitated basic magnesium carbonate. J. R. I. HEPBURN (J.C.S., 1940, 96—99).—Data on the effect of varying concn. of reactants on the composition of pptd. basic Mg carbonate are given. The CO_2 content of the ppt. is a continuous function of that of the solution, suggesting adsorption of HCO_3' ions on a primary ppt. of $Mg(OH)_2$. F. J. G.

Precipitated basic magnesium carbonate. J. E. W. RHODES (Chem. and Ind., 1940, 115).—The formation of basic Mg carbonate by the adsorption of HCO_3' by $Mg(OH)_2$, proposed by Hepburn (preceding abstract), is criticised in the light of *X*-ray measurements by Menzel and Bruckner (A., 1930, 435), who established that the basic salt is a co-

ordination compound, and not, therefore, an adsorption complex of variable composition. D. F. R.

Chemical nature of precipitated basic magnesium carbonate. J. R. I. HEPBURN (Chem. and Ind., 1940, 136—137).—Polemical (cf. preceding abstracts). *X*-Ray analysis of the ppt. may prove untrustworthy if changes in the composition of the ppt. occur while it is being dried. D. F. R.

Hydrate formation with tricalcium silicate. O. E. RADCZEWSKI, H. O. MÜLLER, and W. EITEL (Naturwiss., 1939, **27**, 807).—$3CaO,SiO_2$ gives $Ca(OH)_2$ and Ca hydrosilicates, of which the composition varies with temp. and concn., on hydrolysis. Finely powdered $3CaO,SiO_2$ was shaken with H_2O, and the first reaction product was investigated with the electron super-microscope. It consists of particles of $Ca(OH)_2$ in the form of hemispheres, of diameter 0·1—0·2 μ. If the hydrate formation is carried out in a mixture of $Bu^{\beta}OH$ and H_2O, the hemispheres of $Ca(OH)_2$ are smaller, and are preceded by the formation of disc-shaped particles of $Ca(OH)_2$ of diameter 70—100 mμ. Needles of Ca hydrosilicates are also observed. A. J. M.

Hydrate formation with tricalcium aluminate. O. E. RADCZEWSKI, H. O. MÜLLER, and W. EITEL (Naturwiss., 1939, **27**, 837—838).—Hydrates formed by $3CaO,Al_2O_3$ (I) have been examined with the electron microscope. Hexagonal tables of $3CaO,Al_2O_3,12H_2O$ are formed by shaking (I) with H_2O, and $3CaO,Al_2O_3,6H_2O$ is formed when (I) is shaken with a mixture of $Bu^{\beta}OH$ and H_2O. A. J. M.

Fractional mixed crystallisation using radio-elements. B. GOLDSCHMIDT (Ann. Chim., 1940, [xi], **13**, 88—173).—A detailed account of work already noted (cf. A., 1939, I, 210). W. R. A.

"Chief" and "auxiliary" valency in complex compounds and mobility of co-ordinated particles. A. POLESITZKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 540—541).—Using radioactive I as indicator, it has been found that in the reaction, $HgI_2 + 2KI \rightarrow K_2HgI_4 \rightarrow Ag_2HgI_4 \rightarrow 2AgI + HgI_2$, complete interchange takes place between I atoms of the co-ordinated compound. Interchange also takes place between I atoms of KI and of K_2HgI_4, and between KI and freshly pptd. AgI, but not between IO_3' and I′ ions or BrO_3' and Br′ ions. O. D. S.

Crystalline modification of alumina. I. Inversion of crystalline form of aluminium hydroxide by heating. II. Influence of CaO, MgO, Li_2O, Na_2O, and K_2O on crystal inversion of alumina. K. AKIYAMA (J. Soc. Chem. Ind. Japan, 1939, **42**, 394—396B).—I. Inversion from γ- to α-Al_2O_3 takes place at 1100—1200°.

II. The mixed oxides were heated for 2 hr. at 1700°. *X*-Ray analysis showed that Al_2O_3 containing >5% CaO is in the β-form or containing >3% MgO and 2% Li_2O is in the ζ-form. Both forms are different modifications of Al_2O_3. D. F. R.

Steam-carbon complex. S. MULLER and J. W. COBB (J.C.S., 1940, 177—183).—The interaction between steam and C has been investigated in an attempt to demonstrate the formation and persistence of a complex; by contact and evacuation such a complex has been shown to be produced at 300°, and completely decomposed into H_2 and C oxides by further heating to 1050°. In the early stages of the decomp. H_2 < is equiv. to the O_2 combined as C oxides is obtained, but the balance is restored at higher temp., the final gas evacuated having the "ideal water-gas" composition of H_2 50, CO 50%. The formation at 300° of a C complex of the form $C_x(H_2O)_y$ is postulated; the complex is completely decomposed on raising the temp., but the H_2 from the decomp. is partly retained by the C in the lower temp. stages. Evidence in support of this theory is obtained by using H_2 instead of steam in contact with C. The results obtained are also affected by the form of C used, the degree of steam fixation decreasing as graphitisation proceeds with the formation of large and stable mol. groupings with less peripheral unsatisfied affinities. J. L. E.

Reactions of carbonyl cyanide. R. MALACHOWSKI (Atti X Congr. Internaz. Chim., 1938, III, 240—241).—Carbonyl cyanide (I), m.p. −36°, b.p. 65° (hydrolysed by H_2O to CO_2 and HCN), reacts similarly to $COCl_2$. With compounds of type NH_2R, NHR_2, ROH, and $(RCO)_2O$, HCN is eliminated and CO·CN introduced; with $NPhMe_2$ the condensation is through the CO group. (I) is used for the prep. of *D cyanide*, m.p. ~0·75° higher, b.p. ~0·115° higher, than HCN, d_4^{15} 0·7198. E. W. W.

Interchange of heavy oxygen between water and inorganic oxy-anions. E. R. S. WINTER, M. CARLTON, and H. V. A. BRISCOE (J.C.S., 1940, 131—138).—The interchange between H_2O and several oxy-acids has been investigated, H_2O with an excess *d* due to ^{18}O of 150—200 γ*d* being used, and the interchange being followed by means of flotation-temp. determinations with a SiO_2 float on the micro-scale. The results of previous workers using alkaline solutions are criticised on the ground that interchange took place with sol. silicate produced by the action of alkali on the glass container; in the case of Na_2SiO_3 100% interchange takes place in a very short time. In neutral, acid, or alkaline solution ClO_4', SO_4'', or PO_4''' gives no measurable interchange in 2 days at 100°; ClO_3' and NO_3' both give complete interchange (with decomp.) in acid solution but not in neutral or alkaline solution, whereas N_2O in aq. solution gives no interchange. H_3BO_3 and $Na_2B_4O_7$ give complete O interchange in a very short time at 100°, but Cr_2O_7'' and CrO_4'' in neutral or alkaline solution both take 1 day at 100°. A neutral solution of CrO_4'' at 20° gives an interchange at a measurable rate (time of half-change = 4·5 hr.), but an alkaline solution gives no measurable interchange in 240 hr. at 20°; this is consistent with the view that the interchange occurs solely through the reaction $Cr_2O_7'' + H_2O \rightleftharpoons 2HCrO_4'$. It is concluded that O interchange with oxy-acid anions occurs only when these are known to interact with H_2O or are otherwise chemically changed. J. L. E.

Chemical behaviour of sulphur compounds. I. Hydrolysis of sulphur chloride. II. Disulphur oxide. B. S. RAO (Proc. Indian Acad. Sci., 1939, **10**, A, 423—448, 491—506).—I. S_2Cl_2 was

analysed iodometrically by mixing 8 g. of ~0·05M-S_2Cl_2 in CCl_4 with 25 c.c. of dry CCl_4 containing KI crystals; S_2I_2 was formed and decomposed completely after 6 hr., when free I was titrated with $Na_2S_2O_3$. For the hydrolysis, a weighed quantity of S_2Cl_2 solution was mixed with a known wt. of dry CCl_4 in a separating funnel and the required amount of NaOH, containing 2 c.c. of N-$CdCl_2$, was added. After separation into two layers had taken place, the CCl_4 layer was removed and the amount of S in it was determined. The other layer was analysed for S'', SO_3'', and S_2O_3''. The primary product of hydrolysis appears to be disulphur oxide, S_2O (or its hydrate), which then reacts thus: $S_2O + 4NaOH = Na_2S + Na_2SO_3 + H_2O$ (I); $2Na_2SO_3 + 2S_2O + 2NaOH = 3Na_2S_2O_3 + H_2O$ (II); $2S_2O + 2NaOH = 2S + Na_2S_2O_3 + H_2O$ (III). The sulphate and trithionate, found when dil. NaOH is employed, arise from: $H_2S_2O_3 + H_2O = H_2S + H_2SO_4$; $2H_2S_2O_3 = H_2S + H_2S_3O_6$. The following effects on the hydrolysis by NaOH have been observed: dilution of S_2Cl_2 increases reaction (I) and decreases (III); addition of glycerol to the NaOH increases (II) and (III) but decreases (I), whilst brucine increases (I) and decreases (II) and CH_2O decreases (III); dilution of NaOH (2·0N. → 0·02N.) decreases (I), slightly increases (III), and greatly increases (II). With $Ba(OH)_2$ as hydrolysing agent, (I) and (II) are < but (III) is > with NaOH. S_2I_2 behaves differently from S_2Cl_2 on hydrolysis and tentative explanations are advanced.

II. On passing freshly-prepared SO into dry CCl_4 at −12° to −18° the CCl_4 becomes deep yellow; cryoscopic measurements indicate that it contains complexes of the form S_8,3 or $4S_2O$, which absorb from the ultra-violet up to 4700 A. S_2O is formed thus: $SO + S_2O_2 = S_2O + SO_2$, and is unstable in CCl_4 ($2S_2O = 3S + SO_2$). Thus, on keeping at room temp. for 2·5 hr., the absorption spectrum changes to one identical with that of a synthetic mixture of SO_2 and S corresponding with the S_2O present. The hydrolysis of fresh S_2O with 2N-NaOH [containing $Cd(OH)_2$ in suspension], the hydrolysis of S_2O kept for 24 hr., and the decomp. of fresh S_2O by Hg have been investigated and are discussed. W. R. A.

Chemistry and morphology of basic salts of bivalent metals. IX. Basic nickel nitrate. W. FEITKNECHT and A. COLLET (Helv. Chim. Acta, 1940, **23**, 180—197).—Five basic Ni nitrates have been isolated from $Ni(NO_3)_2$ solutions of concn. up to saturation and over the range room temp.—100°. The probable formulæ are (I) $Ni(NO_3)_2,Ni(OH)_2,6H_2O$; (II) $Ni(NO_3)_2,3Ni(OH)_2$; (III) and (III*a*),
$Ni(NO_3)_2$,3·8—7·4$Ni(OH)_2$,1·3—9·0H_2O;
(IV) $Ni(NO_3)_2,4Ni(OH)_2,7H_2O$;
(V) $Ni(NO_3)_2,8Ni(OH)_2,xH_2O$. The conditions under which each is formed, their properties, their structure and lattice consts. as revealed by *X*-ray analysis, and their isomorphism with other basic Ni salts are described. C. R. H.

Action of Raney nickel on azoimide. L. IRRERA (Atti X Congr. Internaz. Chim., 1938, III, 206—209).—Raney Ni reduces HN_3 or NaN_3 in H_2O to $N_2 + NH_3$. E. W. W.

Complex compounds of platinum and complex amines. A. M. RUBINSTEIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 559—561).—$2(5I,2NH_3,C_5H_5N)Cl_2Pt$ (I) has been prepared from K_2PtCl_4 and $5I,2NH_3,C_5H_5N$. By action with C_5H_5N $(C_5H_5N)_2Cl_2Pt$ (II) is formed, which reacts with $CS(NH_2)_2$ to give $[2CS(NH_2)_2(C_5H_5N)_2Pt]Cl_2$. Thus, by Kurnakov's rule, both (I) and (II) have a *trans*-structure. By action of C_5H_5N on $2(NH_3C_5H_5N)Cl_2Pt$ (III) a tetrammine $[2(NH_3C_5H_5N)(C_5H_5N)_2][PtCl_2]$ is formed, which with K_2PtCl_4 gives $[2(NH_3C_5H_5N)(C_5H_5N)_2Pt][PtCl_4]$, with Cl_2 gives $[2(NH_3Cl_2C_5H_5N)(C_5H_5N)_2Cl_2]PtCl_2$, and with HCl gives $(NH_3C_5H_5N)C_5H_5N\ Cl_2Pt$. By comparison of the reactions of (I) and (III) it is deduced that the linkage between Pt and $5I,2NH_3C_5H_5N$ in (I) is formed between the Pt and I atoms. O. D. S.

Qualitative spectrographic analysis in the arc with graphite electrodes. W. C. PIERCE, O. R. TORRES, and W. W. MARSHALL (Ind. Eng. Chem. [Anal.], 1940, **12**, 41—45).—Methods and apparatus for use with the d.c. arc are described. A comparison of anode and cathode excitation indicates that anode excitation is generally preferable. Factors affecting the sensitivity of detection of an element are discussed, and sensitivity data for the analysis of impurities in NaOH and dolomite, and of trace elements in Si, pig Fe, Pb, and biological ash, are recorded. L. S. T.

New assessments of analytical methods. A. SCHLEICHER (Z. anal. Chem., 1939, **118**, 81—89).—The new assessments of analytical methods necessitated by the introduction of spectro- and micro-methods into analytical chemistry are discussed. L. S. T.

Computing titration blanks. F. W. GLAZE (Ind. Eng. Chem. [Anal.], 1940, **12**, 14—15).—Blanks evaluated by graphical extrapolation, or indirectly by interpolation when the relation is non-linear, are often preferable to those determined directly. When the data deviate non-systematically from a straight line, fitting the curve to the points by the method of least squares is more trustworthy than the method described by Park (A., 1936, 302). L. S. T.

Limit of perceptibility of a qualitative reaction in the approximate determination of an element. G. GUTZEIT (Helv. Chim. Acta, 1940, **23**, 17—24).—Three examples illustrate the principle of the method, which is based on the limit of perceptibility of certain colour reactions. (1) The discoloration of a test paper containing $SbCl_3$ when pressed on the surface of solder can indicate whether the S content is > or < a predetermined limit. (2) The disappearance of colour when solutions of reagents which give colours with Au salts are successively diluted can be applied to the approx. determination of the Au content of minerals. (3) The Au content of minerals can also be determined by adding to solutions of the mineral a series of colour-forming reagents of increasing sensitivity. C. R. H.

Distillation method for determining water in soaps.—See B., 1940, 223.

Volhard and gravimetric determinations of chloride. J. BITSKEI (Z. anal. Chem., 1939, **118**,

164—169).—Two modifications of Volhard's method are described. In the first, a protective solution is used to prevent fading of the red colour at the end-point. The solvent and the solute of this solution must be insol. in H_2O. 10 c.c. of a solution of 4 g. of thymol in 100 c.c. of Et_2O or $C_5H_{11}\cdot OH$ give accurate results. Whenever a protective solvent or solution is used in this determination, powerful agitation throughout the determination is essential. In the second modification, adsorption of $Ag^{\cdot}$ by the pptd. AgCl is prevented by the addition of NH_4NO_3 to the Cl′ solution before $AgNO_3$ is added. After stirring for 4—5 min. the AgCl is filtered off, washed by decantation, and titrated with NH_4CNS. Filtration can be avoided if a special titrating vessel is used. When adsorption of $Ag^{\cdot}$ is thus prevented the results are lower by $\sim$0·7%. In the gravimetric determination of AgCl, addition of NH_4NO_3 also has the advantage that the ppt. can be filtered after 5 min. stirring. L. S. T.

Quantitative separation of chloride, thiocyanate, and cyanide and a qualitative reaction for detecting chloride in potassium thiocyanate. A. Slooff and D. van Duyn (Chem. Weekblad, 1940, **37**, 69—72).—In a modified Treadwell method, the solution (100 c.c.) is acidified with HNO_3 (10 c.c., *d* 1·3) and boiled to remove CNS′ and CN′. Cl′ is determined by titration with $AgNO_3$ solution. CNS′, CN′, and Cl′ is determined by a Volhard titration and CN′ is determined by Liebig's method. KCNS (1 g.) is boiled in dil. HNO_3 to destroy CNS′ and Cl′ is detected in the solution by adding $AgNO_3$ to the warm solution. S. C.

[Applications of] perchloric acid [in analysis].—See B., 1940, 203.

Determination of iodide in mineral waters in presence of bromide and large amounts of chloride. E. Müller and W. Stumpf (Z. anal. Chem., 1939, **118**, 90—93).—The sample is acidified with min. amounts of HCl, and a min. amount of aq. $NaNO_2$ added; the mixture is quickly shaken with CS_2 ($CHCl_3$ dissolves N oxides and leads to error in the titration). The liberated I is titrated with 0·005N-$Na_2S_2O_3$, the vol. of which is multiplied by an empirical factor of 1·6. The method is accurate to within 10% for amounts of I of $\sim$2 mg. per kg. of H_2O. Fe, Mn, and Br′ in the H_2O do not invalidate the results; H_2O_2 liberates traces of Br only after prolonged shaking. Violet solutions of I in CS_2 are decolorised by excess of $NaNO_2$ in presence of 2N-HCl, but not of 2N-AcOH. They are stable towards 3% H_2O_2 + 2N-HCl, but in this case high concns. of NaCl inhibit the oxidation of I′ to I by the H_2O_2. L. S. T.

Determination of fluorine in cryolite by Greeff's method. H. Spielhaczek (Z. anal. Chem., 1939, **118**, 161—164).—The titration of F′ by $FeCl_3$ in presence of pptd. SiO_2,nH_2O (I) gives high results, owing to adsorption of the $FeCl_3$ by (I). Accurate vals. are obtained when (I) is filtered off before titration. By using 1 g. of SiO_2,nH_2O (83% SiO_2) per g. of cryolite in the fusion with K_2CO_3 instead of the 2·5 g. recommended by Greeff (A., 1913, ii, 975) technically useful vals. are obtained. L. S. T.

Determination of fluorine and silicic acid in the Gastein thermal springs. R. Bisanz and E. Kroupa (Chem.-Ztg., 1939, **63**, 689—691).—For determination of F the cooled sample (50 c.c.) is treated with EtOH (20 c.c.) and 0·05% aq. Na alizarinsulphonate (15 drops), and after adding HCl ($\sim$0·1N.) dropwise until the colour is pale yellow, it is titrated with aq. $Th(NO_3)_4$ [$Th(NO_3)_4,4H_2O$ 1 g. in H_2O 1 l.] until the colour changes to reddish-brown. The $Th(NO_3)_4$ solution is standardised with aq. NaF. For determination of SiO_2 the sample (1·5 l.) is treated with Na_2CO_3 and evaporated to 150 c.c. After adding $(NH_4)_2CO_3$ (4 g.) the solution is heated at 40° for 1 hr. and kept overnight. It is then filtered, the ppt. being retained and the filtrate evaporated almost to dryness and treated with HCl until no colour appears with phenolphthalein after warming. 1—2 c.c. of freshly prepared $ZnO-NH_3$ solution are then added and the solution is evaporated to expel NH_3. The ppt. is separated, and the combined ppts. are ashed in a Pt dish and the SiO_2 is separated by evaporation with HCl in the usual way. It is finally determined by the loss in wt. after treatment with HF and H_2SO_4. The concns. observed in various springs at Gastein were F′ 1·77—3·4 and SiO_2 36—45 mg. per kg. J. W. S.

Direct determination of oxygen in metallic oxides and organic substances. M. Schütze (Naturwiss., 1939, **27**, 822).—A method for the direct determination of O in metallic oxides and org. substances involves the conversion of the O into CO by heating with C, and subsequent oxidation of the CO to CO_2, which is determined by the usual methods. A. J. M.

Determination of hypophosphites [in syrup preparations].—See B., 1940, 242.

Apparatus for rapid determination of arsenic in presence of antimony. V. Biskupski (Bull. Soc. Chim. Yougoslav., 1939, **10**, 75—80).—Distillation is conducted in a stream of HCl at 70—100°, when $AsCl_3$, but not $SbCl_3$, distils over. R. T.

Determination of boron in soils.—See B., 1940, 233.

Determination of quartz (free silica) in refractory clays.—See B., 1940, 207.

Determination of carbon dioxide in air and gas mixtures.—See B., 1940, 249.

Determination of small amounts of potassium. T. E. Weichselbaum, M. Somogyi, and H. A. Rusk (J. Biol. Chem., 1940, **132**, 343—356).—The K is pptd. with $Ag_3Co(NO_2)_6$; the Ag is determined titrimetrically and the NO_2' manometrically. Under well-defined experimental conditions a ppt. of const. composition with respect to its relative Ag, K, and NO_2 contents is obtained. The method is as accurate as the $PtCl_4$ method and considerably quicker. It is applicable to the determination of K in human blood-serum. D. F. R.

Colorimetric micro-determination of sodium with manganous uranyl acetate. E. Leva (J.

Biol. Chem., 1940, **132**, 487—499).—Na is pptd. as $NaMn(UO_2)_3(OAc)_9,6H_2O$, the ppt. is washed with Zn uranyl acetate solution saturated with the Mn triple salt and having the same concn. of alcohol as the pptg. reagent, and it is then treated with KIO_4 and the $KMnO_4$ produced is determined colorimetrically. PO_4''' does not affect results but K gives rise to high results if the ratio K : Na exceeds 1·5. Amounts of 0·008—0·01 mg. of Na may be determined with an accuracy of $\pm 8\%$. P. G. M.

Determination of lithium in mineral waters, and a new method for the determination of lithium in silicate rocks. O. Hackl (Z. anal. Chem., 1939, **118**, 1—9).—Difficulties encountered in the extraction of LiCl from the mixed alkali chlorides by $Bu^{\beta}OH$ in Winkler's method (A., 1913, ii, 877) are discussed, and the application of the Noyes and Bray modification of the phosphate test ("Qual. Analysis for the Rare Elements," 1927, 259, 260, 473) to the testing of the Li_2SO_4 is described. Data on the sensitivity of the KIO_4–KOH–$FeCl_3$ test for $Li^{\cdot}$ (A., 1938, I, 582) are given, and the utilisation of the reagent in the determination of the small amounts of $Li^{\cdot}$ occurring in silicate rocks is described. L. S. T.

Test for magnesium with *p*-nitrobenzeneazoresorcinol. Effect of diverse ions. J. P. Mehlig and K. R. Johnson (Ind. Eng. Chem. [Anal.], 1940, **12**, 30—31; cf. A., 1929, 783; A., 1936, 178).—The effects on the test of 44 common ions are tabulated. Many of the ions of groups I—III interfere, but not those of Al, $Sb^{\cdot\cdot\cdot}$, Bi, Cd, $Sn^{\cdot\cdot}$, $Sn^{\cdot\cdot\cdot\cdot}$, and Zn; >60 parts by wt. of NH_4 cause fading of the blue colour. Among the common anions only AsO_4''', CrO_4'', and MnO_4'' interfere. L. S. T.

Determination of magnesium in biological materials.—See A., 1940, III, 275.

Detection of cadmium and magnesium. E. Eegriwe (Z. anal. Chem., 1939, **118**, 98—100).—The neutral test solution, free from $Cu^{\cdot\cdot}$ and $NH_4^{\cdot}$, is treated with aq. Na_2CO_3 and diazoaminobenzene in $COMe_2$, and shaken with $CHCl_3$. When $\nless 0.2$ µg. of Cd is present an orange-red ppt. or turbidity, sol. in the $CHCl_3$, is formed. Most other cations give yellow ppts. $Cu^{\cdot\cdot}$ interferes by forming a green colour, and $Ag^{\cdot}$ by giving a brownish-yellow turbidity in the $CHCl_3$. $Co^{\cdot\cdot}$ and $Ni^{\cdot\cdot}$ react similarly to $Cd^{\cdot\cdot}$, but the colour due to Co changes to brown on shaking. The Ni can be removed from the $CHCl_3$ layer by adding solid dimethylglyoxime, leaving the orange-red colour due to Cd (3 µg.). The sensitivity of the test for Ni is 0·05 µg. per drop. 3 µg. of Cd can be detected in presence of 100 of $Hg^{\cdot\cdot}$, $Bi^{\cdot\cdot\cdot}$, $Al^{\cdot\cdot\cdot}$, $Co^{\cdot\cdot}$, $Ca^{\cdot\cdot}$, and 500 of $Pb^{\cdot\cdot}$, $Mn^{\cdot\cdot}$, $Zn^{\cdot\cdot}$, and $Mg^{\cdot\cdot}$. The yellow to brown oxidation product obtained by shaking p-NH_2·C_6H_4·OH,HCl in dil. aq. NH_3 in air is adsorbed by $Mg(OH)_2$ to give a blue colour. The test is applied after group IIIb to a neutral solution free from $NH_4^{\cdot}$, and will detect 5 µg. of Mg in 0·05 c.c. Cations pptd. by NH_3, and AsO_4''', PO_4''', or SO_3'' interfere. L. S. T.

Micro-determination of cadmium by means of anthranilic acid. P. Wenger and E. Masset (Helv. Chim. Acta, 1940, **23**, 34—38).—The best conditions for the micro-gravimetric determination of Cd according to the separate methods of Schwarz-Bergkampf, Emich, and Pregl have been worked out. C. R. H.

Qualitative procedure for the analysis of group II. J. L. Maynard, H. H. Barber, and M. C. Sneed (J. Chem. Educ., 1939, **16**, 573).—A correction (cf. A., 1939, I, 337). L. S. T.

Analytical behaviour of the group ·CS·NH·. F. Feigl and P. Krumholz (Natuurwetensch. Tijds., 1939, **21**, 239—242).—Dimethylthiopyrimidone interacts with p-NMe_2·C_6H_4·CHO giving *mono-* and *di-(p-dimethylaminobenzylidene)* ($+0.5H_2SO_4$) derivatives. The latter gives a brown ppt. with Hg (2×10^{-7} in 0·1N-HCl; 2×10^{-6} in 0·5N-HCl), Au, Ag, and Pb. The reagent (0·05 g. of the sulphate in 100 c.c. of MeOH) can be used for detecting these metals, especially Hg in acid solution, by spot reactions. The test can be carried out in presence of 1% of Cd, As, Sn, Ni, Co, Fe, Cr, Al, Mn, and Zn salts. High concns. of $Cu^{\cdot\cdot}$ cause a ppt. but 0·01 µg. Hg in 0·1N-HCl can be detected in a solution containing 0·5% Cu. S. C.

Determination of mercury in ointment of mercuric nitrate.—See B., 1940, 242.

Fluorescence of cerium salts in solution. L. Mazza (Annali Chim. Appl., 1940, **30**, 47—50).—Aq. $Ce_2(SO_4)_3$ and $CeCl_3$ show fluorescence at 350—410 mµ. which is inhibited by NO_3', $Fe^{\cdot\cdot\cdot}$, and $Ce^{\cdot\cdot\cdot\cdot}$ owing to absorption of ultra-violet and violet λλ. Analytical applications of the fluorescence are indicated. F. O. H.

Revised procedure for the qualitative analysis of group III cations. W. J. Tomsicek and J. J. Carney (J. Chem. Educ., 1940, **17**, 29—31).—The BzOH–NH_4OBz method (A., 1934, 621) is used to separate $Al^{\cdot\cdot\cdot}$, $Cr^{\cdot\cdot\cdot}$, and $Fe^{\cdot\cdot\cdot}$ from $Ni^{\cdot\cdot}$, $Co^{\cdot\cdot}$, $Mn^{\cdot\cdot}$, and $Zn^{\cdot\cdot}$. The solution containing these ions is neutralised with 3N-aq. NH_3, acidified with 1 ml. of glacial AcOH, treated with 1 g. of NH_4Cl, and diluted to 100 ml. The addition of 25 ml. of 10% NH_4OBz and boiling for 3 min. ppts. the basic benzoates of Fe^{III}, Al, and Cr, which are dissolved in 2N-HCl, and examined in the usual way. MnS, ZnS, CoS, and NiS are pptd. as usual, and after dissolution of the sulphides in 20 ml. of 6N-HNO_3, the Mn is pptd. as MnO_2 by means of $KClO_3$ and conc. HNO_3, and the Zn separated from Co and Ni by NaOH. Pptn. with 8-hydroxyquinoline is recommended as a confirmatory test for $Zn^{\cdot\cdot}$. L. S. T.

Micro-determination of iron with the silver reductor. S. M. Edmonds and N. Birnbaum (Ind. Eng. Chem. [Anal.], 1940, **12**, 60—61).—The macro-procedure of Walden *et al.* (A., 1934, 382) has been adapted to the determination of 0·5—3 mg. of Fe by reducing the size of the reductor to 20 × 1 cm., and using 7 g. of Ag and more dil. reagents. The formation of H_2O_2 in the reductor, and the reductor blank, then become negligible (cf. A., 1936, 813). L. S. T.

Rapid determination of small amounts of iron and manganese in copper–nickel–zinc alloys.—See B., 1940, 212.

Gravimetric determination of tin in bronzes and brasses.—See B., 1940, 212.

Determination of traces of metavanadates. J. MOLLAND (Compt. rend., 1940, **210**, 144—146).—Metavanadates (2·5—20 mg. V per l.) may be determined colorimetrically by using the brown tint produced on addition of the solution to saturated aq. 8-hydroxyquinoline-5-sulphonic acid. The extinction coeff. (ϵ) $\propto$ concn. (c) in solutions in which $[NH_4VO_3]/[C_9H_7O_4NS]$ is $<0·375$, but if this val. is exceeded ϵ increases less rapidly than c. ϵ falls rapidly with increasing p_H, and the determination is best carried out in a NaOAc–AcOH buffer solution. $Fe^{\cdots}$, Cu, Pb, Cd, Al, and Zn interfere, but Li, K, Na, Ca, Sr, Ba, Hg, Tl, Ti, and Mn have no effect. A. J. E. W.

Volumetric determination of bismuth, and of the free acidity of solutions of bismuth salts. L. MALAPRADE (Ann. Chim. Analyt., 1940, [iii], **22**, 5—8).—The sample (oxide, nitrate, or sulphide) is dissolved in the min. amount of HNO_3; the solution is diluted, and neutralised (Me-red) with CO_2-free KOH. A large excess (10 g.) of $Na_2S_2O_3$, which forms $Na_3Bi(S_2O_3)_3$, is added. The solution is then titrated (phenolphthalein) with 0·2M-KOH. The reaction is $2Na_3Bi(S_2O_3)_3 + KNO_3 + 5KOH =$ $BiO{\cdot}NO_3,BiO(OH) + 6NaKS_2O_3 + 2H_2O$. Cl′ and SO_4'' must be absent. Details of procedure for this, and for the determination of the acidity of solutions of Bi salts, are given. L. S. T.

Determination by spectrum analysis of niobium and tantalum in high-alloy steels.—See B., 1940, 211.

Detection of gold. L. S. MALOWAN (Z. anal. Chem., 1939, **118**, 100—102).—Morpholine (I) detects $\nless 2$ µg. of Au by reducing HCl solutions to metal. (I) is added to 2—3 c.c. of test solution until it is alkaline, any pptd. Fe or Cu filtered off, and the filtrate heated to boiling. When Au is present, the solution turns yellow and then bluish-violet, and ultimately gives a bluish-violet ppt. The test can be applied to a HCl extract of Au ores containing Fe. L. S. T.

Thermostat for room temperature control. J. B. GREEN and R. A. LORING (Rev. Sci. Instr., 1940, **11**, 41—43).—The temp. of a room can be kept within 0·05° by means of a Et_2O vapour thermoregulator. Its construction and that of the electrical control circuit are described. C. R. H.

Method for assembling thermocouples. H. M. TRIMBLE (Ind. Eng. Chem. [Anal.], 1940, **12**, 52).—The use of braided Fiberglas sleeving as an insulating material for enclosing the wires of thermocouples is described. L. S. T.

Installation for liquid helium in the Physics Laboratory at Louvain. A. VAN ITTERBEEK (Natuurwetensch. Tijds., 1939, **21**, 233—239).—Further details of the He cryostat described previously (A., 1939, I, 537) are given. S. C.

New method of calculating combustion temperatures. H. ZEISE (Z. Elektrochem., 1939, **45**, 893).—A correction (cf. A., 1939, I, 420).

Laboratory gas furnace for very high temperatures. V. H. STOTT (Trans. Ceram. Soc., 1940, **39**, 1—6).—The design and operation of a small furnace (internal diameter 7 in. × 13 in. high) capable of attaining 1800° are described. The pure Al_2O_3 lining is provided with a tangential opening for the burner, which is fed with air at 70 lb. per sq. in. to overcome the resistance of the necessarily small exit (0·5—0·75 sq. in.) for the gases. J. A. S.

Critical selection of the colorimetric, spectrophotometric, and spectrographic methods for absorption measurements. G. KORTÜM and M. SEILER (Angew. Chem., 1939, **52**, 687—693).—A crit. discussion of absorption measurements including the limitations of the validity of the Lambert–Beer laws, and the principles, reproducibility of results, and disadvantages of colorimetry (subjective and objective), spectrophotometry (subjective and objective), and spectrography. W. R. A.

Wide-range intensity measurements in photoelectric spectrophotometry. W. C. BOSCH and B. B. BROWN (J. Opt. Soc. Amer., 1939, **29**, 466—469).—For a spectrophotometer having four light-sensitivity ranges, if proper grid bias is used on each range, deflexion is $\propto$ incident light intensity within ±0·5% for applied grid potentials at 0—0·3 v. and within 1·5% at 0—0·5 v. A 10^6-fold range of light intensity can be measured with a suitably selected galvanometer system. D. F. R.

Practical photocolorimetry of high sensitivity. I. SORGATO (Chim. e l'Ind., 1940, **22**, 1—5).—The application of two photo-electric cells, one for actual measurement and the other in a compensating circuit, is described. F. O. H.

Dichroscope. N. W. THIBAULT (Amer. Min., 1940, **25**, 88—90.—An apparatus which utilises a polaroid film to show up the dichroism of minerals is described. L. S. T.

Filter for transmission of medium ultraviolet rays and its application. L. MAZZA (Annali Chim. Appl., 1940, **30**, 43—47).—A filter transmitting only λ 335—240 mµ. is afforded by two solutions, viz., 22 g. of $NiSO_4,7H_2O$ and 20 g. of $CoSO_4,7H_2O$ per 100 g. and 12 g. of $NiSO_4,7H_2O$, 2·35 g. of $(NH_4)_2SO_4$, and 8·28 g. of aq. NH_3 (d 0·925) per 100 g. of solution. Applications of these filters are described. F. O. H.

Sector process for photographing electron interferences. F. TRENDELENBURG (Physikal. Z., 1939, **40**, 727—728).—The blackening comparison process, stated by Debye (A., 1939, I, 130, 394) to be unsuitable when applied to mols., is very useful in the investigation of cryst. substances, and especially for crystallites of very small dimensions. A. J. M.

Simple supermicroscope and its application in bacteriology. E. BRÜCHE and E. HAAGEN (Natuurwiss., 1939, **27**, 809—811).—An electron supermicroscope is described, and photographs of bacilli obtained by its aid are reproduced. A. J. M.

Valve potentiometer and its application to p_H determination. H. H. KRETCHMAR (J. Dept. Agric. W. Australia, 1939, **16**, 89—114).—Design and

use of valve potentiometers for p_H determinations are reviewed. An expression is deduced for calculating the optimum val. of external valve anode resistances. A. W. M.

Thallous sulphide photo-e.m.f. cell. F. C. Nix and A. W. Treptow (J. Opt. Soc. Amer., 1939, **29**, 457—462).—The cell is formed by the partial sulphurisation of a Tl disc or evaporated Tl layer, the electron flow being from Tl_2S to Tl. Photosensitivities up to 6×10^{-3} amp. per lumen have been attained. Max. response is at 9800±200 A., with thresholds at 15,000 and 6500 A. The short-circuit current and open-circuit voltage are $\propto$ light intensity at all temp., although there is a slight tendency to saturation at high light intensities. The current is a max. at −45°. Interruption of the light source at 20,000 cycles decreases the photo-response by 75%. D. F. R.

Selenium rectifier for electrolysis. S. Shinkai and T. Nakagawa (J. Soc. Chem. Ind. Japan, 1939, **42**, 396—397B).—The rectifier has been used successfully in Cu determinations. D. F. R.

Excitation of active nitrogen. H. P. Knauss and A. E. Murray (Rev. Sci. Instr., 1940, **11**, 78).—A method of conditioning the tube so as to obtain a continuous flow of active N with relatively low power is described. F. J. G.

Small portable Geiger–Müller counters. R. B. Taft (Rev. Sci. Instr., 1940, **11**, 63—64).—Portable equipment operated by batteries and by a.c. mains is described. F. J. G.

Theory of the electrostatic beta-particle energy spectrograph. II. F. T. Rogers, jun. (Rev. Sci. Instr., 1940, **11**, 19—22; cf. A., 1937, I, 153).—The effects of field distortion at the edges of and between spectrographic plates on the use of the spectrograph have been evaluated and shown to be not inconsiderable where the highest precision is required. Proper location of source and detector can reduce these effects to some extent. C. R. H.

Magnetic beta-ray spectrometer. J. L. Lawson and A. W. Tyler (Rev. Sci. Instr., 1940, **11**, 6—18).—The construction of a β-ray spectrometer of high resolution is described. Resolution formulæ have been derived directly from the geometrical arrangement of the source and slits so as to determine both the optimum relative sizes of source and slits and an accurate transmission factor. Factors influencing counting rate are discussed and correction terms are evaluated. C. R. H.

Differential apparatus, using medium frequency [alternating current] and an amplifier, for detection and measurement of magnetic permeability in very small specimens of substance. A. Colombani (Compt. rend., 1940, **210**, 47—48).—Two coaxial coils of unequal size, but with the nos. of turns adjusted to give close compensation, are arranged astatically in a uniform a.c. field (1000 cycles per sec.). Introduction of a magnetic specimen along the axis destroys the balance of the coils, and a resultant e.m.f. is produced and detected by a high-gain amplifier; μ is deduced from the shift of a variometer necessary to restore balance. The conductivity of the specimen can also be deduced by compensation of a phase change. μ for thin metallic films can be determined to within 2%. A. J. E. W.

Balance for automatic evaporation. L. Gros (Ann. Chim. Analyt., 1940, [iii], **22**, 9—10).—A metal disc, fixed at the end of a counterpoised beam, supports the vessel containing the liquid over a small ring burner. The oscillation of the beam controls, at the fulcrum, both the supply of gas to the burner and of liquid to the container. Equilibrium is quickly established, and evaporation becomes automatic. With a container of 7 cm. diameter, ~1·25 l. of H_2O per 24 hr. can be evaporated. L. S. T.

Rate of flow from a burette. B. V. J. Cuvelier (Natuurwetensch. Tijds., 1939, **21**, 243—248).—The rate of flow from a burette is considered mathematically and an apparatus with a const. rate of flow for carrying out accurate titrations is described. S. C.

Micro-gasometric apparatus.—See A., 1940, III, 274.

Concentration of ^{13}C by thermal diffusion. A. O. Nier (Physical Rev., 1940, [ii], **57**, 30—34).—A thermal diffusion column employing CH_4 (cf. A., 1940, I, 65) is described. A determination of the separation factor of the column for various pressures indicated a quant. agreement with theory (cf. Furry, A., 1939, I, 395). With a reservoir attached to the top of the column, CH_4 containing > four times the normal amount of $^{13}CH_4$ was produced. N. M. B.

Concentration of isotopes by thermal diffusion: rate of approach to equilibrium. J. Bardeen (Physical Rev., 1940, [ii], **57**, 35—41).—Mathematical. The time-dependent partial differential equation involved in the theory of the operation of a Clusius thermal diffusion column is discussed. Solutions presented give the concn. of a given isotope at any point in the column as a function of time. Good agreement with Nier's experimental results is found (cf. preceding abstract). N. M. B.

Preparation of microscopic glass spheres. C. R. Bloomquist and A. Clark (Ind. Eng. Chem. [Anal.], 1940, **12**, 61—62).—The modification of Sollner's method (A., 1939, I, 223) now presented gives spheres $\not>$25 μ. from Pyrex glass by using an ordinary laboratory blast lamp. The spheres are graded by settling in H_2O. L. S. T.

Hot wire cutter for glass tubing. A. A. Hirsch (Ind. Eng. Chem. [Anal.], 1940, **12**, 48).—The wire, carrying a 350-g. wt. at each end, is looped around the glass and heated electrically. L. S. T.

Magnesite crucible. W. J. Crook, J. R. Cunningham, and J. R. Cady (Ind. Eng. Chem. [Anal.], 1940, **12**, 48—51).—The manufacture of laboratory crucibles by sintering crushed magnesite brick in a graphite mould at 2000° in a high-frequency furnace is described. The crucibles are impervious to liquid basic slags which permeate and disintegrate the MgO and magnesite crucibles commercially available. L. S. T.

Removal of adhered rubber stoppers. A. J. Bailey (Ind. Eng. Chem. [Anal.], 1940, **12**, 52).—

The shank of a small triangular file is used as a probe. L. S. T.

Apparatus for qualitative semimicro-analysis. H. H. BARBER (Ind. Eng. Chem. [Anal.], 1940, **12**, 58—60).—Filter tubes, a pressure bulb, a filter stick, and a H_2O-bath are described. Their use is illustrated by reference to the semimicro-analysis of group II. L. S. T.

Accurate direct-reading manometer for corrosive and other gases. R. SPENCE (Trans. Faraday Soc., 1940, **36**, 417—419).—The manometer, the construction of which is described, consists essentially of a glass bellows filled with Hg which serves as an indicator. The relation between scale reading and pressure is linear over a range of 1 atm. and the accuracy is 0·25 mm. F. L. U.

Quartz fibre manometer of high accuracy and simplicity. G. WETTERER (Z. tech. Physik, 1939, **20**, 281—283).—An instrument depending on the damping of a vibrating SiO_2 fibre is described. A. J. M.

Electric hygrometer. F. W. DUNMORE (J. Res. Nat. Bur. Stand., 1939, **23**, 701—714).—Constructional and operational details are given of an electric hygrometer which is adapted to the rapid measurement of upper-air humidities. W. R. A.

Determination of mol. wt. at low pressures by means of V. Meyer's method. D. MILOSAVLEVIĆ and M. JOVANOVIĆ (Bull. Soc. Chim. Yougoslav., 1939, **10**, 57—62).—Meyer's method is adapted for low pressures. R. T.

Recording tensiometer. P. L. DU NOÜY (Chim. et Ind., 1940, **43**, 181—187).—The tensiometer is operated electrically, the Pt ring being withdrawn from the liquid every 2 min. and the torsion in the wire recorded on moving paper. The instrument is used to demonstrate the rapid fall followed by a slow recovery of the surface tension (γ) when a surface-active substance is added to certain colloidal solutions. A similar fall is observed when oleic acid is added to H_2O contaminated with a trace of oil or grease; the subsequent recovery of γ depends on the existence of polar mols. in the oil or grease. Removal of these mols. from an oil by filtration results in the recovery of γ being inhibited. D. F. R.

Protection of thin metal films against oxidation. W. EHRENBERG (J. Sci. Instr., 1940, **17**, 41—42).—A film of $Zn_3(PO_4)_2$, evaporated from a Pt boat, affords better protection than quartz. It is unaffected by EtOH and will withstand moderate exposure to undried air. D. F. R.

Vapour-proof laboratory stirrer. G. CALINGAERT (Ind. Eng. Chem. [Anal.], 1940, **12**, 51).—The stirrer described has oil-impregnated bronze or stainless steel bearings, and can be used for high-speed stirring with boiling org. liquids in a closed system without leakage or deterioration. It operates more smoothly than the conventional Hg-seal stirrer, and does not trap liquid. L. S. T.

Stirring machine. J. BITSKEI (Z. anal. Chem., 1939, **118**, 170—171).—Apparatus for agitating liquids in open vessels without loss is described and illustrated. L. S. T.

Rotary viscosimeter. A. H. NISSAN, L. V. W. CLARK, and A. W. NASH (J. Sci. Instr., 1940, **17**, 33—38).—The instrument measures viscosities >10 poises with an overall accuracy of 1%. A new method of eliminating end effects is described. D. F. R.

Cleaning Jena glass filters. H. HAWLEY (Analyst, 1939, **65**, 27).—Jena filters with which the speed of filtering has become reduced through continued use are restored to their original efficiency by treatment for a few moments with 4% aq. HF, followed by immediate washing. E. C. B. S.

Test-tube rack. R. F. ERVIN (J. Lab. clin. Med., 1939, **25**, 320—322).—The rack consists of a central zig-zag bar supported at each end and with coil springs along the whole length on each side. C. J. C. B.

Safety valve to prevent return of water in water pumps. S. RISTIĆ (Bull. Soc. Chim. Yougoslav., 1939, **10**, 85—86).—Minor modifications of Fournier's device (A., 1938, I, 278) are proposed. R. T.

Percolation process. J. BÜCHI and K. FEINSTEIN (Pharm. Acta Helv., 1936, **11**, 121—164, 209—235, 279—305, 334—349; Chem. Zentr., 1937, i, 3515).—Repercolation, diacolation, and evacolation processes do not possess all the advantages claimed. The best results are obtained with a slightly conical percolator of the American pattern. Details of recommended procedure are given. A. J. E. W.

Accessory for Neubauer's ammonia distillation apparatus for Kjeldahl nitrogen determination. I. ESAT (Z. allg. türk. Chemiker-Ver., 1936, **2**, 139—146; Chem. Zentr., 1937, i, 3525).—A filling funnel which permits addition of alkali to the solution in the distilling flask without loss of NH_3 is described. A. J. E. W.

Simplest ultracentrifuge with photographic recording. J. W. MCBAIN and A. H. LEWIS (Trans. Faraday Soc., 1940, **36**, 381—384).—The ultracentrifuge is air-driven and requires no expensive optical accessories, the photographs being shadow reproductions of the capillary tubes containing the solution under examination. Tests made with erythrocruorin and with carboxyhæmoglobin gave results nearly as good as those obtained with standard ultracentrifuges. Details of construction and operation are given. F. L. U.

Hormone studies with the ultracentrifuge. III. Application of Toepler's "schlieren" method to the analytical ultracentrifuge. J. A. CHILES and A. E. SEVERINGHAUS (Rev. Sci. Instr., 1940, **11**, 71—76).—Details of the optical system are given. F. J. G.

Construction, testing, and operation of laboratory fractionating columns. C. C. WARD (U.S. Bur. Mines, 1939, Tech. Paper 600, 36 pp.).—A review of the literature. A. R. PE.

Atomic hypothesis of William Higgins. E. R. ATKINSON (J. Chem. Educ., 1940, **17**, 3—11). L. S. T.

Lazarus Ercker and his "Probierbuch." Sir John Pettus and his "Fleta Minor." E. V. ARMSTRONG and H. S. LUKENS (J. Chem. Educ., 1939, **16**, 553—562).—Historical. L. S. T.

Geochemistry.

Radioactivity of the hydromineral springs of Châtel-Guyon (Puy-de-Dôme). Springs very rich in thoron. A. LEPAPE and M. GESLIN (Compt. rend., 1940, **210**, 223—225).—Rn analyses for H_2O (0·05—2·93) and gases (0·27—1·53 millimicrocuries per l.) from ten springs are recorded. Solubility equilibrium between the gases and H_2O is not always reached at the point of emergence. The highest activities are associated with low temp. and mineral content. The Ra contents are $38·5—53·8 \times 10^{-12}$ g. per l. of H_2O. An exceptionally high thoron content and a high ratio of thoron to meso-Th I are detected. A. J. E. W.

High proportions of mesothorium I in mineral waters of Châtel-Guyon (Puy-de-Dôme) and of radium in boring water from Martres d'Artières (Puy-de-Dôme). R. DUCHON (Compt. rend., 1940, **210**, 225—228; cf. preceding abstract).—Measurements of the thoron activity show that the H_2O contains meso-Th I ($0·125—0·55 \times 10^{-12}$ g. per l.) and possibly Th-*X*, but no Th or radio-Th. At Martres d'Artières the Ra content is 293×10^{-12} g. per l. of H_2O, the other springs giving $26·5—54·8 \times 10^{-12}$ g. per l. A. J. E. W.

Manganese in a thermal spring in West-Central Utah. E. CALLAGHAN and H. E. THOMAS (Econ. Geol., 1939, **34**, 905—920).—The Abraham hot spring of Juab Co., Utah, has yielded 715 tons of Mn oxide ore containing ~20% Mn and 0·26% S. The hot alkaline waters average 3900 p.p.m. of dissolved solids (NaCl, $CaSO_4$, $MgCl_2$, and $CaCO_3$) and show 0—1·2 p.p.m. of Mn, but no appreciable Mn is now being pptd. The bed of Mn and Fe oxides is covered mainly by porous calcite, and the ore is a porous aggregate of psilomelane and pyrolusite. These minerals have been formed by the prolonged action of hot alkaline solutions; the original mineral was probably wad. A chemical analysis [J. J. FAHEY] of the Mn ore is recorded. L. S. T.

Petrology of the Shallowater, Lubbock Co., Texas, meteorite. W. F. FOSHAG (Amer. Min., 1939, **24**, 185).—The meteorite is a coarse diogenite, consisting of enstatite 83·5, forsterite 5, oligoclase 1·5, and Ni–Fe and troilite 10%. L. S. T.

Crystallographic studies of meteoric iron J. YOUNG (Phil. Trans., 1939, **A**, **238**, 393—421).—The mutual orientations of kamacite and taenite, and their relationships to the Widmanstätten structure, have been studied by *X*-ray methods. In the Cañon Diabolo meteorite the (110)-kamacite is parallel to the (111)-octahedrite and the [001]-kamacite is at 4·1° to the [110]-octahedrite. Similar orientation of the kamacite is shown in the Butler and Carlton meteorites, whilst the taenite orientation is identical with that of the octahedrite. In heat-treated artificial Ni (10%)–Fe the orientations of the γ and α phase constituents resembled those of taenite and kamacite, respectively. The orientation studies confirm that the body-centred α crystals of kamacite result from pptn. from a single face-centred γ lattice of uniform orientation the axes of which are those of the octahedrite. The bulk distortion of the Widmanstätten structure and the rotations of individual crystals are consistent with the effects of plastic shearing of the whole portion of meteorite examined. D. F. R.

Bore-hole temperatures in the Transvaal and Orange Free State. L. J. KRIGE (Proc. Roy. Soc., 1939, **A**, **173**, 450—474).—The results of temp. measurements in five deep bore-holes are tabulated with information as to the nature and thickness of the rock strata. The increase of depth per 1° varies over wide ranges, being highest in the dolomite and lowest in the lava. G. D. P.

Heat flow in South Africa. E. C. BULLARD (Proc. Roy. Soc., 1939, **A**, **173**, 474—502).—The heat-conductivity of 49 rocks from bores in S. Africa was measured. The mean heat flow is calc. from these results and the data of Krige (cf. preceding abstract). The figure obtained, $1·16 \times 10^{-6}$ g.-cal. per sq. cm. per sec., is $\ll$ those usually quoted but is in agreement with the result obtained by Benfield for bores in Europe (see below). There is no foundation for the opinion that the heat flow is lower in S. Africa than in Europe. G. D. P.

Terrestrial heat flow in Great Britain. A. E. BENFIELD (Proc. Roy. Soc., 1939, **A**, **173**, 428—450).—The heat flow is determined by measurement of the thermal conductivity of the rock and the temp. gradient in five bore-holes. The result obtained, $1·46 \times 10^{-6}$ g.-cal. per sq. cm. per sec., is $<$ previous estimates. In two of the deepest bores some evidence of an ice-age was found and its date was fixed at about 9000 B.C. G. D. P.

Radioactivity of rocks. E. ROTHÉ and (MME.) A. HÉE (Compt. rend., 1940, **210**, 30—32).—An ionisation electrometer is used to determine the α-ray activity (*A*) of layers of the powdered specimen of variable thickness (*d*). With Th preps. the *A–d* curve is linear, but Ra preps. give an ascending curve terminating in a horizontal line, which indicates that *A* depends only on the surface layers. Preps. containing Th and Ra give curves intermediate in type, and the relative proportions of these elements present in rocks can be estimated from the *A–d* curves. Preliminary *A* data are given for 14 rocks. A. J. E. W.

Heat of diffusion of helium as criterion of the suitability of minerals for the estimation of age by the helium method. E. K. GERLING (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 570—573).—The heat of diffusion of He in massive liparite, poikilitic liparite, monazite grains, monazite dust, and uraninite grains has been measured. The criterion of suitability of the mineral for age estimation is a heat of diffusion for He $>$34,000 g.-cal., which is found, among these minerals, only for massive liparite. O. D. S.

Reflectivity and colour of minerals. W. PARRISH (Amer. Min., 1939, **24**, 190—191).—A technique for measuring the diffuse reflectivity of opaque and non-opaque minerals with the Hardy recording photoelectric spectrophotometer has been developed. L. S. T.

Minerals of the Yellow River placers. A. L. ZAGIANSKY (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 51—52).—The mineralogical composition of black sands taken from test-pits sunk in the valley of the Yellow River (Shu district) is described. The most interesting rare minerals found are monazite, zircon, cassiterite, and topaz. A. J. M.

Magnetite and hæmatite veins in Triassic lavas of Nova Scotia. A. P. HORNOR, jun. (Econ. Geol., 1939, **34**, 921—930).—Small Fe-bearing veins in the Triassic basalts are described. They contain amethystine quartz, zeolites, specular hæmatite, and magnetite (I). The mineral paragenesis and the origin of tho veins are discussed. (I) contains [R. B. ELLESTAD] Fe_2O_3 71·30, FeO 20·80, MgO 6·42, CaO trace, Mn 0·03, P_2O_5 trace, SiO_2 1·40, total 99·95%. L. S. T.

Iron ore deposits in Manchoukuo. T. SUDO (Rept. Inst. Sci. Res. Manchoukuo, 1939, **3**, 317—370).—The Fe ore deposits of Rōrei, Dairishikō, and Hachidōko are described, and their origins discussed. Chemical analyses are recorded. *X*-Ray powder photographs show that thuringite changes to hæmatite at ~1000°. L. S. T.

Geology and petrology of the iron ore deposits of Mandi State, Punjab. S. K. ROY and A. N. MUKHERJEE (Quart. J. Geol. Soc. India, 1939, **11**, 49—77).—The history of tho production of Mandi Fe is reviewed. The magnetite and micaceous hæmatite schists are described, and their chemical analyses given. Mandi ore compares favourably with that of Mysore. The geology of the ores, their probable yields, and the economic possibilities are discussed. L. S. T.

Identification of diamond in the Canyon Diablo iron. C. J. KSANDA and E. P. HENDERSON (Amer. Min., 1939, **24**, 677—680).—Small black diamonds associated with graphite in the troilite area of this Fe have been identified by means of *X*-ray and microscopical examinations. L. S. T.

Variation of hardness in the diamond. E. H. KRAUS and C. B. SLAWSON (Amer. Min., 1939, **24**, 661—676).—The known variation of hardness in the diamond is discussed in terms of crystallographic theory, crystal structure, valency linkings, cleavage, and growth and solution phenomena. L. S. T.

Granite pegmatites of the Mt. Antero region, Colorado. G. SWITZER (Amer. Min., 1939, **24**, 791—809).—A granite stock in this region contains numerous, small, closely-associated Be-rich pegmatites and veins. The pegmatites contain the typical magmatic minerals microcline and quartz, and later hydrothermal minerals, beryl, phenakite (I), albite, bertrandite, and fluorite. The crystallographic elements of (I) are recalc. in a new setting. L. S. T.

Pegmatite dykes of the Bridger Mountains, Wyoming. T. G. McLAUGHLIN (Amer. Min., 1940, **25**, 46—68).—The central area of pre-Cambrian rocks in this range consists mainly of black hornblende schist, which has been invaded by large masses of granite, followed by two intrusions of granite pegmatite. The older intrusion was followed by SiO_2- and K-rich hydrothermal solutions, which replaced the schist by quartz and sericite; the younger intrusion was followed by solutions that partly replaced the original dyke minerals and pptd. cleavelandite, muscovite, tourmaline, beryl, garnet, columbite, tantalite, chalcopyrite, lepidolite, and petalite. L. S. T.

Fluorine content of rocks and ocean-bottom samples. E. S. SHEPHERD (Amer. J. Sci., 1940, **238**, 117—128).—The F contents, determined by the Willard–Winter method (A., 1933, 242), of numerous eruptive rocks, lava flows, African Rift area and the Katmai area rocks, sedimentary and plutonic rocks, and ocean-bottom samples are tabulated and discussed. Plutonic rocks and ocean-bottom samples average 0·04%, and lava flows 0·01%; obsidians show the greatest average concn. Local concns. of F occur in certain regions. No relation between F content and that of other rock-forming elements, *e.g.*, P, is apparent. The Willard–Winter method is easily applied to rocks, and, with a 2-g. sample in absence of B, is accurate to ±0·001%. L. S. T.

Composition of the Khibiny apatites. M. I. VOLKOVA and B. N. MELENTEEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 120—122).—Complete analyses and descriptions of twelve samples from different deposits are given. O. D. S.

Arsenic in the apatites of the Khibiny tundra. Z. M. GILEVA and B. N. MELENTEEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 118—119).—The As in Khibiny apatites has been determined nephelometrically by means of the Tiele–Bugo reagent. The As content varies from 0·00006 to 0·00024% and is not correlated with the type of deposit. O. D. S.

Isomorphic substitutions in apatite. D. McCONNELL (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 46—50).—The structure proposed by Belov (A., 1939, I, 284) for carbonate apatites is criticised. The substitution of C for Ca in these minerals is discussed. The general formula for an apatite containing Ca, P, C, (F, OH), and O may be written $Ca_6(P_{6-y}C_y)[O_{26-x}(F,OH)_x](Ca_{4-z}C_z)$, where $x \leq 8$, $y \leq 6$, $z \leq 4$, $x, y, z \geq 0$. A. J. M.

Occurrence of a deposit of trona. W. C. MENDENHALL (Science, 1940, **91**, 11—12).—A thick deposit of trona occurring at a depth of 1600 ft. in Sweetwater Co., Wyoming, is described. The insol. material associated with the trona includes clay 3·9, shortite 1·4, and pyrite 0·25%. Small quantities of northupite and pirssonite are present in the drilled core. L. S. T.

Montmorillonite from West Sulyukta. S. M. JUSUPOVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 212—214).—The chemical composition of the grey, compact, oily clay alternating with coal-seams in the Sulyukta coal deposits S.E. of Dragomirovo, Uzbek S.S.R., suggests it to be a montmorillonite clay from its high Mg content (5·18%) and the ratio of $SiO_2 : Al_2O_3$ of 4 : 1. Thermal analysis of the clay itself and of the mud by the Le Chatelier differential method indicates the coexistence in the clay of montmorillonite and kaolinite, the latter in small quantity only—a conclusion confirmed by *X*-ray analysis. The high content of Al_2O_3 (23·6%) and

fusibility range (1720—1760°) show the clay to be refractory. F. H.

X-Ray study of natural and artificial mullites. H. P. Rooksby and J. H. Partridge (J. Soc. Glass Tech., 1939, **23**, 338—346T).—Three varieties of "mullite" were distinguished by differences in the axial ratios of the unit cell: α-mullite, made from pure oxides, corresponding with $3Al_2O_3,2SiO_2$ (SiO_2 28·2, Al_2O_3 71·8%), β-mullite containing excess of Al_2O_3 in solution [the transition α → β is progressive and reaches $2Al_2O_3,SiO_2$ (Al_2O_3 78%)], and γ-mullite containing small amounts of Fe_2O_3 and/or TiO_2 in solution. Only the β and γ varieties have been found as natural minerals. J. A. S.

Rocks devoid of felspar in proximity to sakenites (Madagascar): chemical composition of the deposits. A. Lacroix (Compt. rend., 1940, **210**, 193—196).—Deposits associated with sakenites (cf. A., 1940, I, 46), which contain no felspar and consist of pyroxene or amphibole with minerals rich in Al and Mg (spinel, sapphirine), are described; detailed analyses [Raoult] are given, including those of five sakenites. The deposits as a whole are rich in Al, Ca, and often Mg, but poor in SiO_2, Fe, alkalis, and P, and they contain no Ti. A. J. E. W.

Dehydration of natural hydrated copper and cobalt oxides (X-ray investigation). V. Billiet and A. Vandendriessche (Natuurwetensch. Tijds., 1939, **21**, 311—322).—X-Ray examination shows that the minerals stainierite, mindigite, and trieuite ($Co_2O_3,3H_2O$) are converted into spinels, Co_3O_4, (a 8·11, 8·09, 8·06 mμ.) when heated. There is no evidence of the formation of Co_2O_3. S. C.

Geochemistry and mineralogy of the Crimea. A. E. Fersman (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 204—206).—A brief review. F. H.

Evidence of krypton in iodyrite. F. W. Hillis, R. C. McReynolds, and E. B. Feiring (J. Chem. Physics, 1940, **8**, 128—129).—A persistent line at 5870·9 A. in the spectrum of fused iodyrite (AgI) indicates the presence of Kr. W. R. A.

Garnet segregations in granite gneiss of Dekalb Co., Georgia. J. G. Lester (J. Geol., 1939, 47, 841—847).—The characteristics of numerous segregations of almandite garnet occurring in a biotite-granite gneiss, and probably the result of convection currents in the magma, are described. L. S. T.

Specularite-alunite mineralisation at Hickeys Pond, Newfoundland. A. L. Howland (Amer. Min., 1940, **25**, 34—45).—A unique association of alunite (I) with specularite is described, and its bearing on the origin of (I) discussed. L. S. T.

Oriented inclusions of staurolite, zircon, and garnet in muscovite. Skating crystals and their significance. C. Frondel (Amer. Min., 1940, **25**, 69—87).—Crystals of staurolite, zircon, and garnet included in muscovite (I) from Manhattan schist are described. The included crystals have been deposited from suspension on the {001} face of the (I), and have moved about on this face before being buried by continued growth of the mica. The skating effect is ascribed to variation of interfacial surface energy with the relative orientation of the crystal faces in contact. L. S. T.

Occurrence of celestite in the phosphatic nodules of Utatur. N. Jarayaman and K. R. Krishnaswami (Current Sci., 1939, **8**, 553).—A white platy material, found in cracks in crushed specimens of phosphatic nodules from the Utatur area, consists of $SrSO_4$ ~93, $BaSO_4 + CaSO_4$ ~4, and quartz ~3%. A lump of celestite, occurring in the gypsum beds in the same locality, was a massive aggregate of columnar crystals each 10—12 mm. long. W. R. A.

Mineralogy of Monche-Tundra. I. N. Tschirkov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 126—129).—The composition and genesis of the Monche-Tundra, Kola peninsula, Cu–Ni deposits are described. O. D. S.

Calculation of the activation energy and heat of fusion of felspars and pyroxenes from viscosity measurements. M. P. Volarovitsch (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 938—941).—Using existent η data for melts of felspars and pyroxenes the η/T relationship is calc. by the formula $\eta = Ae^{B/RT}$ and from η/T curves deductions regarding the co-ordination no. of the melts and the activation energy, B, are made. Correlation between B and heat of fusion is discussed. W. R. A.

Gigantic aegirite-augite crystals from the plutonic rocks of Gremyakha-Vyrmes (Kola peninsula). A. A. Polkanov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 935—937).—In the gigantic grained ijolite-urtite-pegmatites from the plutonic rocks of Gremyakha-Vyrmes, subparallel ægirite-augite (I) attachments are frequently found up to 30—50 cm. long; the grain size is rarely >1—2 cm. long. Loose blocks of subparallel (I) attachments have also been observed at the shore of Lake Gremjakha, which have been freed possibly after the decomp. of the leucocratic portion of the pegmatite, or possibly originated from decayed ægirinite which previously covered the ijolite-urtite-pegmatite. A specimen 110 × 35 × 20 cm. has no natural cryst. growth faces and is formed by cracks along the prismatic cleavage planes or occasional splittings due to frost weathering. Under the microscope $N_pC = 9°$, dark-green polychroism along N_p and N_m, greenish-yellow along N_g. Chemical analyses of the specimen are given. W. R. A.

Alunite from the Zaglik deposit (Transcaucasia). M. A. Kaschkni (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 931—934).—Alunite from the Zaglik deposit is characterised by, $N_g = 1·5923$, $N_p = 1·5831$, $N_g - N_p = 0·12$, d 2·7. Chemical analysis gives $R_2O,2·5Al_2O_3,3·5SO_3,4H_2O$ (R = K 56%, Na 44%). A certain amount of SiO_2 not characteristic of alunite is due to a fine dissemination of this as quartz in the body of the mineral investigated. Alunites from the Zaglik (I) and the Zhuravlinsk (II) deposits, and an aluminite (III) from the Gaal deposit, have been analysed thermally. (I) and (II) show similar heating curves. When heated from 20° to 520° alunite does not change; at 520° (525°) a sharp drop in the differential curve corresponds with

the endothermic reaction, which is most intense for (I); at 735° (753°) a sharp jump in this curve corresponds with the exothermic effect over a narrow temp. range; immediately afterwards an inflexion in the curve corresponds with the endothermic reaction, which ends at 804° to 815°; thence up to 1100° no other thermal effects are exhibited. In contrast, two low-temp. endothermic effects are recorded for (III), and a high-temp. exothermic effect at 853°, passing to a very intense endothermal reaction. It is concluded that the first endothermic effect separates H_2O, whereas during the second separation of SO_3 and decomp. of the substance take place. W. R. A.

Distribution of indium in Kazakhstan. S. A. BOROVIK and N. M. PROKOPENKO (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 925—928).—The presence of In in various minerals from different districts has been established, particularly in black sphalerites but also in cleiophane, jarosites, cerussite, chalcopyrites, pyrites, bornite, galenite, and chalcozite. Other less common metals are found also in amounts which vary according to the mineral. The absence of In from several minerals is reported. W. R. A.

Alteration of ilmenite. J. G. KOENIGSBERGER (Econ. Geol., 1939, **34**, 844).—The alteration of ilmenite to leucoxene and limonite by surface weathering (Merritt, A., 1939, I, 585) is queried. L. S. T.

Alteration of ilmenite. E. S. MOORE (Econ. Geol., 1939, **34**, 931; cf. preceding abstract).—Leucoxene and associated secondary minerals are generally due to igneous after-effects and not to weathering. L. S. T.

Metasomatism of country near ore-bodies and its possible economic significance. E. DE C. CLARKE and H. A. ELLIS (Econ. Geol., 1939, **34**, 777—789).—The economic val. of a quant. and comparative study of metasomatism is pointed out. The Au deposits of W. Australia are discussed by way of illustration. L. S. T.

Mt. Baker [Washington], a cascade volcano. H. A. COOMBS (Bull. Geol. Soc. Amer., 1939, **50**, 1493—1509).—The lavas are all pyroxene andesites. Most of them contain hypersthene of an unusual type. Chemical analyses of the andesites are recorded. L. S. T.

Geology and development of Mill Close Mine, Derbyshire. J. G. TRAILL (Econ. Geol., 1939, **34**, 851—889).—History, production, stratigraphy, and the ore-bodies are described. Chemical analyses of the limestone are recorded. Primary minerals are galena, practically Ag-free (1—1·5 oz. per ton), sphalerite containing 1% of Cd, calcite, fluorite, and barite. Secondary minerals are calamine (hemimorphite), cerussite, greenockite, with rare dundasite, hydrozincite, and aurichalcite. H_2O flow is heavy, and deep secondary mineralisation can be accounted for by artesian circulation. L. S. T.

Metasomatism associated with tertiary mineralisation in New Guinea. N. H. FISHER (Econ. Geol., 1939, **34**, 890—904).—The geology of the area, and the four types of Au-bearing lodes are described. General and local metasomatism are discussed. L. S. T.

Miargyrite crystals from Randsburg, California. J. MURDOCH (Amer. Min., 1939, **24**, 772—781).—The 47 cryst. forms observed contain two that are new. A new chemical analysis [F. A. GONYER] is compared with 4 older ones. L. S. T.

Asbestos and chromite deposits of Wyoming. R. H. BECKWITH (Econ. Geol., 1939, **34**, 812—843).—Deposits from several localities in Wyoming are described. Chrysotile (I) with cross fibre up to $\pm 1{\cdot}5$ in. long occurs in serpentine (II). Brittle (I) shows extensive replacement by quartz, and brittleness and harshness in (I) from the (II) type of deposit may result from the introduction of SiO_2 with or without reaction to form talc. The chromite of Casper Mountain occurs disseminated, and in bands and lenses in tremolite-chlorite-talc schist. Laboratory concentrates contain sufficient Cr_2O_3 for the manufacture of Fe–Cr; others contain excessive amounts of Fe. L. S. T.

Manganese mineralisation at Tombstone, Arizona. C. A. RASOR (Econ. Geol., 1939, **34**, 790—803).—Pipe-like bodies of Mn oxides are mined in the limestones of this district. They are derived from the sulphide, alabandite, which oxidised to sulphate, and then reacted with the limestone to ppt. compact masses of psilomelane, polianite, and minor Mn oxides. The rare ZnO,Mn_2O_3, hetærolite, is also present. L. S. T.

Silver-pitchblende deposit at Contact Lake, Great Bear Lake area, Canada. G. M. FURNIVAL (Econ. Geol., 1939, **34**, 739—776).—The general geology of the area, and the structure, history, mineralogy, and paragenesis of the veins of the "B.E.A.R." deposit are described. Native Ag is widespread and abundant. It contains small amounts of Hg, but no Sb. It was deposited at temp. $>200°$, and is largely hypogene. A chemical analysis [F. HECHT] of the pitchblende is recorded. The ratio Pb : U indicates an age of 65×10^7 years. L. S. T.

Petrology of the alkaline intrusive at Blue Mountain, Ontario. M. L. KEITH (Bull. Geol. Soc. Amer., 1939, **50**, 1795—1826).—The Blue Mountain alkaline mass, which is intrusive into hornblende-biotite schist, has been examined systematically by means of Rosiwal analyses, and chemical analyses of six type specimens, and of the albite, nepheline (I), and microcline that are the chief constituents of the mass. Spectroscopic examination shows that Cs, La, Nb, Ti, and Zn have been conc. in the high-Fe minerals, that Ga is conc. in (I), magnetite, and corundum, and that Zr and Yt are conc. in pegmatitic (I). The chemical uniformity of the intrusive and its mineral variations indicate an alkaline magma with a composition approximating to that of the average rock now in existence. L. S. T.

Silicified wood in dolomite. J. D. BARKSDALE (Amer. Min., 1939, **24**, 699—704).—The black petrified wood found in Upper Triassic dolomite beds of the Sonoma Range, Nevada, is preserved by the infiltration of siliceous material which crystallised as quartz

(I). Where the wood was sound the growth of (I) was affected by the cell walls, but where it was weak the (I) damaged the cell structure. The assumption that coniferous woods act as dialysers is untenable. L. S. T.

Serendibite and associated minerals from the New City Quarry, Riverside, California. G. M. RICHMOND (Amer. Min., 1939, **24**, 725—726).—Serendibite (I), α 1·719, β 1·722, γ 1·724, occurs as a massive granular aggregate in thin irregular replacement bands in the dolomitic limestone, which it replaces incompletely. It is intimately associated with diopside as an early hydrothermal-contact-metamorphic replacement mineral of the limestone. Plagioclase felspar is also associated with (I). L. S. T.

Behaviour of serpentines between 500° and 650°. J. W. GRUNER (Amer. Min., 1939, **24**, 186).—A criticism (A., 1937, I, 432). All chrysotiles change to olivine (I), and probably colloidal SiO_2, when heated in air for 4—19 days at 560°; at 650°, but not at 560°, antigorites change relatively rapidly to (I). In CO_2, they change to (I) within 2—22 days at 560°. Contrary to the results of Caillère (*loc. cit.*), no formation of enstatite was observed at 560° or 650°. L. S. T.

Occurrence of tinstone in the pre-Cambrian of Western Ontario. E. M. BURWASH (J. Geol., 1939, **47**, 767—768).—At Eagle Lake, W. Ontario, early pre-Cambrian metamorphic rocks are intruded by two granites, the earlier of which, a grey granite, has dykes of a pegmatite which, in one locality, take the form of a tinstone-bearing pegmatitic greisen. This and other occurrences in E. Manitoba indicate a Sn-bearing area ~150 miles long. L. S. T.

Marshite and other minerals from Chuquicamata, Chile. O. W. JARRELL (Amer. Min., 1939, **24**, 629—635; cf. A., 1939, I, 163).—Marshite, CuI, with atacamite, lines fractures in the sericitised and kaolinised granodiorite. The crystals are colourless or light yellow, and contain [F. A. GONYER] Cu 33·01, I 66·67, Ag none, Cl 0·33, total 100·01%; ρ is 5·68. Olivenite, $Cu_3As_2O_8,Cu(OH)_2$, α 1·780, β 1·820, γ 1·865, occurs as small crystals embedded in porous aggregates of a green arsenate, probably chenevixite. Libethenite, $Cu_3P_2O_8,Cu(OH)_2$, α 1·702, β 1·743, γ 1·785, is rare, and occurs in kaolinised granodiorite. Darapskite, $NaNO_3,Na_2SO_4,H_2O$, α 1·390, β 1·481, γ 1·488, occurs intimately mixed with kroehnkite and bloedite. Wulfenite also occurs in dark grey masses associated with antlerite. L. S. T.

Hypotheses of quartz orientation in tectonites. H. W. FAIRBURN (Bull. Geol. Soc. Amer., 1939, **50**, 1475—1491).—Three hypotheses of quartz orientation in tectonics, based on twinning, translation, and fracture (cleavage), are discussed. The evidence favours the fracture hypothesis of Griggs and Bell (A., 1939, I, 110). L. S. T.

Chemical composition of "gold cupride." M. P. LOSHETSCHKIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 451—454).—Carabash "gold cupride" was shown by *X*-rays to be a mixture of Au (*a* 4·06 A.) and a Cu–Au solid solution (*a* 3·83, 60 at.-% Au). Analytical data are given. H. J. E.

Mineralisation of the auriferous deposits of Săcărâmb (Nagyag) [Roumania]. D. GIUŞCĂ (Bull. Acad. Sci. Roumaine, 1936—37, **18**, 97—103).—Changes occurring during mineralisation of the Au-bearing deposits of the above district are discussed. O. J. W.

Some alkaline eruptive rocks and some lamprophyres of the region of Ogradina (Department of Severin). A. CODARCEA (Bull. Acad. Sci. Roumaine, 1936—37, **18**, 147—153).—A geological description of the region of Ogradina (Roumania). O. J. W.

Physical and mechanical properties of Roumanian rock salt. M. STAMATIU (Bull. Acad. Sci. Roumaine, 1936—37, **18**, 41—51).—Sp. gr., hardness, compressibility, plasticity, and other mechanical data are recorded. O. J. W.

Salinity of the miocene clays of the Transylvanian basin. L. MRAZEC (Bull. Acad. Sci. Roumaine, 1936—37, **18**, 207—212).—The origin of the salinity is discussed. O. J. W.

Physico-chemical properties of kaolinic clays. L. LONGCHAMBON and J. ZAJTMANN (Bull. Soc. franç. Min., 1939, **62**, 5—88).—The p_H of Beaujard clay, measured against a H_2 electrode, reaches a steady val. when the clay content of the suspension is >2%. The finer particles of a suspension are more basic than aggregates of particles, and reach a steady p_H at a clay content of 1%. The decrease in p_H produced by electrodialysis of the clay is recorded graphically. Curves showing the neutralisation of the clay-H by alkalis, and also by NaOH in presence of KCl and of Na_2SO_4, are reproduced and discussed. Adsorption of acids by the clay, the neutralisation of acids and bases in its presence, the neutralisation of clays freed from org. matter, and the behaviour of clays from other localities have been investigated. L. S. T.

Quantitative study of pleochroic haloes. IV. New types of haloes. G. H. HENDERSON and F. W. SPARKS. **V. Genesis of haloes.** G. H. HENDERSON (Proc. Roy. Soc., 1939, **A**, **173**, 238—249, 250—264; cf. A., 1937, I, 275).—IV. Four types of halo are described; measurements of the ring radii are given and the haloes are attributed to α-particles from certain later members of the U family with short periods.

V. Six types of halo are recognised; in addition to the four described above, which are called "extinct," there are the two "active" types due to the presence of U and Th in the nuclei. It is suggested that the extinct haloes arose from hydrothermal solutions which diffused through conduits or clefts in the biotite crystals depositing particular radioactive elements at certain centres of pptn. By this continuous process a sufficient quantity of the short-lived element is gradually segregated in the halo nucleus. All four extinct types may have originated in this way; in the active types the nucleus may have been formed prior to the crystallisation of the biotite. All the halo rings can be ascribed to known radioactive elements. G. D. P.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

MAY, 1940.

Sparking potential in deuterium and hydrogen. A. LEEMANN (Helv. Phys. Acta, 1939, **12**, 397—414).—Data are recorded for a homogeneous electric field with gas pressures 2—30 mm. Hg and electrode distances 2·5—5 mm. The min. sparking potentials found are 249 v. at 10·5 mm. for H_2 and 268 v. at 12·3 mm. for D_2, for 1 mm. electrode distance.
L. J. J.

Positive point-to-plane corona in pure argon, hydrogen, and nitrogen. G. L. WEISSLER (Physical Rev., 1940, [ii], **57**, 340—341).—Data for potential, current, oscillograph amplitude, and amplification in the case of the pre-onset phenomena of single avalanche pulses, burst pulses, streamers, and self-sustaining corona are tabulated and discussed, and the stages and characteristics of the phenomena are described in detail.
N. M. B.

Continuous spectrum of the carbon arc. H. MAECKER (Z. Physik, 1939, **114**, 500—514).—The dependence of the continuous absorption coeff. of a stable arc on frequency, temp., and electron pressure has been examined, and from the frequency-dependence it is found that the continuous spectrum is due to transitions of free electrons.
L. G. G.

Rotational analysis of the first negative band system of oxygen. II. T. E. NEVIN (Proc. Roy. Soc., 1940, **A**, **174**, 371—378; cf. A., 1939, I, 111).—The (0, 2) and (2, 0) bands of the first negative system were photographed and analysed. The mol. consts. of five bands of the system are tabulated.
G. D. P.

Halogen molecule spectra. II. Interval relations and relative intensities in the long wavelength spectra. R. S. MULLIKEN (Physical Rev., 1940, [ii], **57**, 500—515; cf. A., 1934, 1288).—Mathematical. Expressions deduced are considered in relation to analyses of experimental data for the absorption spectra of the halogens.
N. M. B.

Positive column in potassium vapour. B. KLARFELD (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 658—662).—Probe measurements have been carried out in discharges in K vapour at 0·00012—0·002 mm. Hg. Satisfactory agreement with the low-pressure plasma theory of Langmuir and Tonks is found up to 0·001 mm. At higher pressures, discrepancies due to collisions of positive ions with K atoms are found.
L. J. J.

Probability of excitation of a potassium atom. V. FABRIKANT (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 663—664).—From the data of the preceding paper, the effective cross-section of the K atom for excitation by electron impact is calc. as $2{\cdot}0 \times 10^{-14}$ sq. cm.
L. J. J.

Infra-red arc spectrum of germanium. C. C. KIESS (J. Res. Nat. Bur. Stand., 1940, **24**, 1—5).—The more intense lines in the range 5265—11,145 A. of the arc spectrum of Ge have been recorded photographically. Most of the lines have been classified as combinations between the $^3P_0$ and ^1P terms of the $5s$ configuration and new singlet and triplet terms of the $5p$ configuration. The lines in the region 5200—6000 A. observed by Lunt (A., 1925, ii, 611) belong to the Ge I spectrum, and, like the similar lines of C I and Si I, are probably due to the $5s$—$6p$ transition.
J. W. S.

Molecular spectrum of iodine excited by fluorescence (in presence of nitrogen) and by active nitrogen. A. ELLIOTT (Proc. Roy. Soc., 1940, **A**, **174**, 273—285).—The fluorescence spectrum of I vapour in the presence of 1 atm. of N_2 is found to consist of four separate band systems, two of which are analysed. The effect of different pressures of N_2 on the intensity of the bands was investigated, and the fluorescence spectra are compared with the spectrum obtained by I vapour excited by active N.
G. D. P.

Normal electron configuration of singly ionised gadolinium. W. E. ALBERTSON, H. BRUYNES, and R. HANAU (Physical Rev., 1940, [ii], **57**, 292—293; cf. A., 1935, 556).—The normal electron configuration of Gd II is $4f^75d6s$. Data for calc. and observed g vals., energy levels, quantum nos. deduced from Zeeman effect patterns obtained with a field of 81,500 gauss, and λλ, intensities, and combinations of multiplets are tabulated.
N. M. B.

Electron concentration and temperature in the mercury high-pressure discharge and their determination through broadening of the spectral lines. P. SCHULZ (Z. Physik, 1939, **114**, 435—447).—From measurements of the broadening of the $3D$ terms of the Hg spectrum (which are sensitive to the Stark effect) the relation between electron density and work (w. per cm.) is obtained. By use of the Saha equation temp. in the discharge are calc.
L. G. G.

Characteristics of the glow–arc transition in mercury vapour. F. A. MAXFIELD (Physical Rev., 1938, [ii], **53**, 204).—Results of an investigation of the probability of the transition from glow to arc discharge at graphite electrodes under controlled cathode conditions are recorded.
L. S. T.

Quenching of mercury resonance radiation by ethylene. E. W. R. STEACIE (Canad. J. Res., 1940, **18**, **B**, 44—46).—The quenching of Hg resonance radiation (λ 2537) by C_2H_4 corresponds with a quenching cross-section of 48×10^{-16} sq. cm.
F. J. G.

Zeeman effect in fields above 50,000 gauss. E. BACK and R. BEZLER (Z. Physik, 1939, **114**, 257—264).—Apparatus is described for measuring the Zeeman effect on gases, using an electromagnet with poles separated by 0·4 mm. and an appropriately designed light source. L. G. G.

Distribution of energy in the continuous spectrum of the sun between 4500 and 3300 A. A. ARNULF, D. CHALONGE, and G. DÉJARDIN (Compt. rend., 1940, **210**, 325—327).—The intensity distribution in the solar continuum has been examined by a photometric comparison of spectrograms of the sun's disc and a H_2 tube at 66 λλ between 3290 and 4538 A. The results can be approx. represented by a single mean colour temp., 6200° K. The colour temp. of the centre of the disc is ~6600° K.

A. J. E. W.

Detection of ultra-violet solar radiation at 2150 A. E. MEYER, F. MÜLLER, and K. ZUBER (Helv. Phys. Acta, 1939, **12**, 415—420).—A criticism of Kiepenheuer's results (cf. A., 1938, I, 590).

L. J. J.

Red shift of the nebular spectrum lines. I. M. FREEMAN (Physical Rev., 1938, [ii], **53**, 207).—Observed displacements can be accounted for by assuming a secular decrease of the val. of *g*. L. S. T.

Fine structures in the *K*-absorption edges of iron at low temperatures. S. AOYAMA and T. FUKUROI (Sci. Rep. Tôhoku, 1940, **28**, 410—422).—The fine structure of the *K*-absorption edge of Fe has been photographed in a vac. spectrograph at room temp. and at —185° with absorbing screens of Fe, cementite, magnetite, and hæmatite. The principal edge of Fe metal consists of double edges with separation 9·3 v. and secondary structure extending to ~400 v. For the minerals the edges are single with width 2—3 v. The positions of the principal edges for various Fe^{II} and Fe^{III} compounds have been measured and are tabulated. The edges of Fe^{II} compounds are nearer to those of the metal than those of Fe^{III} compounds. O. D. S.

Influence of the chemical bond on the *K*β group of the *X*-ray spectrum of chromium. M. A. BLOCHIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 379—382).—The lines in the *K*β spectrum of Cr from metallic Cr, Cr_2O_3, $Cr_2(SO_4)_3$, K_2CrO_4, $SrCrO_4$, $BaCrO_4$, $PbCrO_4$, and natural chromite have been investigated, and the observed differences are discussed. A. J. M.

Dependence of the intensity of characteristic *X*-radiation on potential. A. HENTSCH (Fortschr. Geb. Röntgenstrahlen, 1937, **55**, 89—92; Chem. Zentr., 1937, i, 3598).—The dependence of intensity (I) on the voltage applied to the *X*-ray tube (V) has been studied for the *K*-lines of Sn, Cd, Mo, Cu, Ni, Co, and Fe, and the *L*-lines of Ta, Sn, Cd, Pd, Mo, Cu, and Ni, by photometric measurements on photographs. With const. V, the relation $I = C(V - V_0)^n$ (V_0 = excitation potential) is not strictly obeyed, as n falls with increasing V_0, and the relation fails if V_0 is > an optimum val., $V_w = 1{\cdot}38(Z + 2{\cdot}5)$ (Z = at. no.), when the I–V_0 curve bends towards the V_0 axis.

A. J. E. W.

***L* emission and absorption spectra of thorium and its characteristic levels.** (MLLE.) Y. CAUCHOIS and (MLLE.) M. L. ALLAIS (J. Phys. Radium, 1940, [viii], **1**, 44—50).—A comprehensive examination of the *L* emission spectrum of Th has involved the measurement of all the strong lines, the demonstration of numerous weak lines of dipoles, quadrupoles, or forbidden lines, and of numerous satellites, and the determination of their intensities, and particularly with the emissions of the *P* levels of Th (P_{I}, $P_{II,III}$, $P_{IV,V}$). The energy vals. determined for all the levels of Th taking part in normal *X* emission are different from accepted vals., and can be used in the interpretation of the corpuscular spectra of the heavy elements. The discontinuities in the *L* absorption spectrum of Th have also been analysed. W. R. A.

Energy states of the valency electrons in some metals. I. 7_1. Emission and absorption of *X*-rays in zinc and zinc oxide. M. SATÔ (Sci. Rep. Tôhoku, 1940, **28**, 398—409; cf. A., 1938, I, 167).—The results of Johnston on the fine structure of the *M*-absorption edge of Zn (A., 1939, I, 167) are discussed. *M*-absorption is due to transitions from the multiplet levels M_{II} and M_{III} to the $(4s, 4p)^3P$ level of Zn I. In correction to previous work (*loc. cit.*) the main process in L_{II}, L_{III} absorption is transition to the $(4s, 4p)^3P$ level. A similar correction is made in the characterisation of the *L* edges of ZnO.

O. D. S.

***M* and *N* spectra of palladium and silver. *N* and *O* spectra of gold in the region 90 to 200 A.** H. SAUVENIER (J. Phys. Radium, 1940, [viii], **1**, 63—67).—An experimental study of the *X*-ray spectra of Pd, Ag, and Au has shown the existence of new rays which have been completely identified, the great intensity of which is due to the Auger effect. Bands attributable to the free electrons in these metals were also observed, the magnitude and the distribution of intensity of which conform to the electronic theory of metals, and provide a confirmation of the experimentally-determined electrical conductivity and paramagnetic properties of these metals. A satisfactory estimation of the average internal potentials of these metals has been made. W. R. A.

Thermionic constants of tungsten as a function of crystallographic direction. M. H. NICHOLS (Physical Rev., 1940, [ii], **57**, 297—306; cf. Martin, A., 1940, I, 1).—A method is described for recrystallising W wire into long single crystals occupying the whole cross-section of the wire and so oriented that one of the face diagonals is parallel to the axis of the wire. The temp.-dependence of the emission associated with the different crystal directions was investigated and fitted to an empirical equation the consts. of which are evaluated for each direction. Results show that the vals. of the consts. obtained from measurements on polycryst. wire are characteristic of a weighted average of the properties of the various crystal surfaces and thus have only empirical val., indicating that past attempts to relate observed to theoretical vals. of emission consts. have no great significance.

N. M. B.

Electron affinity of chlorine. J. J. MITCHELL and J. E. MAYER (J. Chem. Physics, 1940, **8**, 282—285).—

The electron affinity of Cl_2, measured from the ratio of ions to electrons and atoms leaving a hot W surface, is ~92·7 kg.-cal., but the accuracy of the result is limited by the reactivity of the Cl_2. W. R. A.

Radiative stopping (Bremsstrahlung) of fast electrons in thin layers. L. Artzimovitsoh and M. Bredov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 650—652).—The effective cross-section of Al, Cu, Sn, and Pb atoms for radiative retardation of electrons of energies 1 Mv. and 2 Mv. is $\propto$ (at. no.)^2, and varies with initial electron energy in the manner predicted by Bethe and Heitler. The depth at which retardation radiation has max. intensity increases with initial electron energy and decreases with increasing at. no. L. J. J.

Multiple scattering of fast electrons. C. W. Sheppard and W. A. Fowler (Physical Rev., 1940, [ii], **57**, 273—280; cf. A., 1939, I, 2).—The scattering of 5—17-Me.v. electrons and positrons, measured in Pb foils of thickness 0·015 and 0·038 cm., in C laminæ of thickness 0·132 and 0·381 cm., and in Al foil 0·118 cm. thick, is in agreement with certain requirements of Williams' multiple scattering theory. For C the experimental magnitude of the mean scattering agrees satisfactorily with theory, but in Al and Pb it is 85% and 60%, respectively, of the theoretical. N. M. B.

Multiple scattering of electrons. S. Goudsmit and J. L. Saunderson (Physical Rev., 1940, [ii], **57**, 552).—Mathematical. Numerical computations based on a method previously reported (cf. A., 1940, I, 89) are represented by approx. formulæ for comparison with experimental data. N. M. B.

Polarisation of electrons by scattering. L. Landau (Physical Rev., 1940, [ii], **57**, 548; cf. Rose, A., 1939, I, 168).—Mathematical. It is shown that the failure of experiment to observe any appreciable polarisation by scattering is due to the fact that the scattered electrons observed have their deflexion not in a single act of scattering but as a result of multiple scattering. N. M. B.

Scattering and polarisation of electrons. M. E. Rose (Physical Rev., 1940, [ii], **57**, 280—288).—Mathematical. The possibility of accounting for the small polarisation of electrons, observed in double scattering experiments, and the anomalously small scattering of fast electrons in heavy scattering materials, by assuming non-Coulombian forces near the nucleus is investigated. Results for scattering and asymmetry, at 90° in Au, when only the $s_{\frac{1}{2}}$ or $p_{\frac{1}{2}}$ wave is scattered are discussed in relation to observation, and show that it is necessary to assume either a large range or a specialised form for the non-Coulombian forces. The specialised form involves certain unsatisfactory consequences. Alternatively the anomalous scattering and asymmetry must be explained on grounds other than the existence of non-Coulombian forces. N. M. B.

Inner motion of the electron. II. A. Papapetrou and H. Hönl (Z. Physik, 1939, **114**, 478—479; cf. A., 1939, I, 394).—Theoretical. A continuation of earlier work. L. G. G.

Positive ion emission from nickel. G. A. Jarvis (Physical Rev., 1940, [ii], **57**, 335).—At temp. of appreciable vaporisation ions were obtained of relative masses 58 and 60 corresponding with the two most abundant Ni isotopes. Ni^+ ions were observed from 5 separate filaments. Similar investigations on Fe and Co filaments have been so far unsuccessful. N. M. B.

Asymmetry of effective cross-section for collisions of the second kind. V. L. Ginzburg (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 653—657).—Mathematical. L. J. J.

Tenth Report of the Committee on Atomic Weights of the International Union of Chemistry. G. P. Baxter, M. Guichard, O. Hönigschmid, and R. Whytlaw-Gray (J. Amer. Chem. Soc., 1940, **62**, 669—672).—The report covers the period from Sept. 30, 1938, to Sept. 30, 1939. The following changes are recommended: H, 1·0081 to 1·0080; Fe, 55·84 to 55·85; Lu, 175·0 to 174·99. W. R. A.

Chemical elements and naturally occurring atoms from the viewpoint of isotope and nucleus investigation. O. Hahn, S. Flügge, and J. Mattauch (Physikal. Z., 1940, **41**, 1—14).—A table giving mass no., no. of neutrons in the nucleus, isotopic wts., the relative abundance of isotopes, packing fraction, mass defect, and chemical at. wt. calc. from mass spectrographic data for each element is given. It embraces data up to the end of 1939. A table showing the max. relative abundance of isotopes at present regarded as non-existent is also given. A. J. M.

Radioactive standards. L. F. Curtiss, C. Goodman, A. F. Kovarik, S. C. Lind, C. S. Piggot, and R. D. Evans (Physical Rev., 1940, [ii], **57**, 457).—Preliminary details of Ra, Th, and 12 standard rock samples in prep. for general reference are given. N. M. B.

Bremsstrahlung of radium-*E*. E. Stahel and J. Guillissen (Physical Rev., 1940, [ii], **57**, 341—342; cf. A., 1940, I, 140).—Mathematical. An investigation of the intensity and quality of the radiation by comparison of the experimental and theoretically deduced absorption curve in Pb, and a check of the radiation quantum theory in the range 150—1000 ke.v. N. M. B.

Formation of helium from α-radiators. II. Determination of the disintegration constants of uranium and radium. P. L. Günther (Z. physikal. Chem., 1939, **185**, 367—374).—By direct determination of liberated He a val. ~10% too high for the disintegration const. of U has been obtained; the discrepancy is probably due to the presence of radioactive impurities. For Ra good agreement with the physical val. has been obtained. F. J. G.

Nuclear *K*-electron capture and negative β-emission. E. C. Campbell (Physical Rev., 1938, [ii], **53**, 206).—Theoretical. L. S. T.

Masses and velocities of three radium-*B* β-particles. Relativistic mass of the electron. M. M. Rogers, A. W. McReynolds, and F. T. Rogers, jun. (Physical Rev., 1940, [ii], **57**, 379—383; cf. Zahn, A., 1938, I, 287).—An accurate determination, made by means of an electrostatic spectrograph, of m/e and v for three Ra-B β-particles shows that,

for velocities up to $0{\cdot}75c$, the particles obey the Lorentz model for electrons rather than the Abraham model. The experimental uncertainty is $<0{\cdot}1$ of the magnitude of the difference between the two models. N. M. B.

γ-Radiation from nitrogen bombarded by deuterons. E. R. GAERTTNER and L. A. PARDUE (Physical Rev., 1940, [ii], 57, 386—389; cf. Crane, A., 1940, I, 90).—The energies and relative intensities of the γ-rays from N_2 bombarded by 700-ke.v. deuterons were measured by the positron–electron pairs and recoil electrons ejected from thin laminæ inside a cloud chamber. The distribution of pairs ejected from a Pb lamina 0·026 cm. thick shows two strong components of energy $7{\cdot}2\pm0{\cdot}4$ and $5{\cdot}3\pm0{\cdot}4$ Me.v., a no. of weaker components due to radiation of $\sim$4 and 2 Me.v., and a no. of pairs extending up to 11 Me.v. The distribution of recoil electrons from a C lamina 0·12 cm. thick indicates two strong groups of energy 4·2 and 2·2 Me.v. The 7·2-Me.v. radiation is attributed to the reaction $^{14}N + {}^{2}H \rightarrow {}^{12}C + {}^{4}He$, and the 5·3-Me.v. component to an excited state of ^{15}N of this energy according to the reaction $^{14}N + {}^{2}H \rightarrow {}^{15}N + {}^{1}H$. An attempt is made to correlate the energies and intensities of the γ-rays produced by excited states in ^{12}C, ^{15}N, and ^{15}O according to several reactions. N. M. B.

Measurements of γ-ray energies. S. C. CURRAN, P. I. DEE, and J. E. STROTHERS (Proc. Roy. Soc., 1940, A, 174, 546—558).—A magnetic spectrograph for measuring the energies of the recoil electrons produced by γ-radiation is described. The instrument can be used in the range 0·5 to 16×10^{6} ev. and is constructed for analysis of γ-radiation emitted by proton bombardment of light elements or by radioactive sources. The accuracy of the method was established by investigation of Th-C'' and it has been applied to the γ-radiation emitted by ^{24}Na, ^{56}Mn, and ^{38}Cl and to the radiation emitted by F under proton bombardment. G. D. P.

Behaviour of slow neutrons in water and paraffin. A. BOUWERS (Physica, 1940, 7, 193—198).—A simple method of measuring the yield of slow neutrons produced in paraffin or H_2O by a powerful source, by means of a very thin detector, *e.g.*, Rh, placed at the point where the neutron density is to be measured, is discussed theoretically. A formula is given for the reflexion coeff. (albedo) of a plane boundary. L. J. J.

"Albedo" of a hydrogenated substance for slow-moving neutrons. W. DE GROOT and K. F. NIESSEN (Physica, 1940, 7, 199—204).—Bouwers' formula (cf. preceding abstract) is substantiated and extended. L. J. J.

Transmission of neutrons of different energies through quartz crystals. M. D. WHITAKER, W. C. BRIGHT, and E. J. MURPHY (Physical Rev, 1940, [ii], 57, 551).—The transmission of neutrons with energies $<$ and $>$ those previously reported (cf. A., 1939, I, 396) was measured. Results support the view that the increased transparency of material in single-crystal form is due to interference effects, since the high transparency largely disappears when the λ of the neutrons is decreased by a factor of $\sim$7. The cross-section of the quartz 4·2 cm. thick for slow C neutrons is $<$ the val. $4{\cdot}3\pm0{\cdot}6 \times 10^{-24}$ sq. cm. previously found for thinner samples. N. M. B.

Radioactive carbon of long half-life. S. RUBEN and M. D. KAMEN (Physical Rev., 1940, [ii], 57, 549; cf. Pollard, A., 1940, I, 51).—The chemical treatment, for the isolation of an active product, of a graphite target after bombardment for 120 hr. with 40 μ-amp. of 7—8-Me.v. deuterons is described. The reactions $C \rightarrow CO_2 \rightarrow CaCO_3 \rightarrow CO_2$ yielded a gas showing an activity 5 times as great as that from the $CaCO_3$. The upper energy limit of the radiation is 90 ± 15 ke.v. The activity is probably ^{14}C of long half-life formed by $^{13}C\,({}^{2}_{1}D,{}^{1}_{1}H)\,{}^{14}C$. N. M. B.

The neutrons from the disintegration of fluorine by deuterons. T. W. BONNER (Proc. Roy. Soc., 1940, A, 174, 339—351).—CaF_2 and KF targets were bombarded by 950-kv. deuterons and the He recoils were recorded by stereoscopic photography of a cloud chamber. Several groups of neutrons were observed and it is concluded that the nuclear reaction is $^{19}F + {}^{2}H \rightarrow {}^{20}Ne + {}^{1}n$. G. D. P.

Radioactive isotopes of tellurium. G. T. SEABORG, J. J. LIVINGOOD, and J. W. KENNEDY (Physical Rev., 1940, [ii], 57, 363—370; cf. A., 1939, I, 295).—A study, with help of a chemical method of separation, of three pairs of activities shows that, for each pair, the longer-lived activity constitutes an isomeric transition from an upper to a lower level in the Te nucleus, and that the shorter-lived activity is due to β-particle decay from the lower level to an I isotope. Data for half-lives and methods of production for these and for a single (^{121}Te) activity are: ^{131}Te [$1{\cdot}2\pm0{\cdot}2$ days $\rightarrow$ 25 ± 5 min. $\rightarrow$ ^{131}I (8 days) $\rightarrow$ ^{131}Xe] Te (d, p); Te (n, γ); U (n, —). ^{129}Te [32 ± 2 days $\rightarrow$ 72 ± 3 min. $\rightarrow$ ^{129}I (?)] Te (d, p); Te (n, γ); Te (n, $2n$); Te (γ, n); U (n, —) ^{129}Sb (4·2 hr.) $\rightarrow$ ^{129}Te. ^{127}Te [90 ± 2 days $\rightarrow$ $9{\cdot}3\pm0{\cdot}5$ hr. $\rightarrow$ ^{127}I] Te (d, p); Te (n, γ); Te (n, $2n$); I (n, p); Sn (α, n); U (n, —) ^{127}Sb (80 hr.) $\rightarrow$ ^{127}Te. ^{121}Te [125 ± 5 days $\rightarrow$ ^{121}Sb] Sb (d, $2n$); Sb (p, n); Sn (α, n). N. M. B.

Production of radium-*E* and radium-*F* (polonium) from bismuth. J. M. CORK, J. HALPERN, and H. TATEL (Physical Rev., 1940, [ii], 57, 371—372).—Bi bombarded with 10-Me.v. deuterons yields Ra-*E* and Ra-*F*, corresponding respectively with the capture of a neutron and of a proton. The yield, found as a function of exciting energy, is for Ra-*F* $<25\%$ of that of Ra-*E*. Since the probabilities of loss of a neutron and proton from the nucleus are about equal, this is evidence that the deuteron has a low probability of entering the nucleus but rather obeys an Oppenheimer–Phillips process. The cross-sections of formation are: Ra-*E* 4×10^{-28} and Ra-*F* 9×10^{-29} sq. cm. N. M. B.

Possible production of radioactive isotopes of element 85. D. R. CORSON, K. R. MACKENZIE, and E. SEGRÈ (Physical Rev., 1940, [ii], 57, 459).—Bi bombarded with 32-Me.v. α-particles gives a product emitting ranges of α-particles of $\sim$6·1 and $\sim$4·2 cm., both groups decaying with 7·5-hr. half-life. A preliminary report of attempts to establish the

chemical identity of this substance shows that it cannot be Tl, Pb, Bi, Po, or any known element up to U, and is probably element 85 although its chemical properties are much closer to those of Po than to those of I. N. M. B.

Yield of nuclear reactions with heavy elements. V. F. WEISSKOPF and D. H. EWING (Physical Rev., 1940, [ii], **57**, 472—485).—The cross-sections for different kinds of nuclear reactions are calc. by statistical methods (cf. A., 1937, I, 546; Konopinski, A., 1938, I, 430) for heavy elements (A >50) as functions of the energy (>1 Me.v.) of the bombarding particles. The excitation curves of several (p, n) reactions were measured for elements A 60—115, and it is found that the measured cross-sections and their dependence on the energy suggest a nuclear radius $1{\cdot}3 \times 10^{-13} \times A^{1/3}$ cm. for these elements. N. M. B.

Capture cross-sections for thermal neutrons in thorium, lead, and uranium 238. L. MEITNER (Nature, 1940, **145**, 422—423).—The experiments described give $(2{\cdot}5 \pm 0{\cdot}2) \times 10^{-24}$ and $(6{\cdot}0 \pm 0{\cdot}3) \times 10^{-24}$ sq. cm. for the cross-sections of thermal neutrons in Pb and Th, respectively. Using the Th capture cross-section and the ratio of β-ray activities of ^{239}U and ^{233}Th, the cross-section calc. for ^{238}U is $(1{\cdot}5 \pm 0{\cdot}2) \times 10^{-24}$ sq. cm. (cf. A., 1939, I, 398). L. S. T.

Distribution in energy of the fragments from uranium fission. M. H. KANNER and H. H. BARSCHALL (Physical Rev., 1940, [ii], **57**, 372—378).—The ionisation measured for single-fission fragments gives no.–energy curves showing peaks corresponding with 65 and 98 Me.v. The ionisation produced by the two fragments simultaneously, measured by a thin foil coated with U, gives a no.–energy curve having one peak at 159 and a half-width at 30 Me.v. N. M. B.

Secondary neutrons from uranium. L. A. TURNER (Physical Rev., 1940, [ii], **57**, 334).—Mathematical. It is shown that two sets of experiments by Halban *et al.* (cf. A., 1939, I, 398; 1940, I, 5) lead to nearly the same val. for the no. of secondary neutrons per fission, and indicate that an explosive chain reaction cannot occur for any mixture of H_2 and U. N. M. B.

Application of the "emanation capacity" of uranium compounds to the production of transmutation products of uranium. Two short-lived alkali metals. O. HAHN and F. STRASSMANN (Naturwiss., 1940, **28**, 54—61).—A method for obtaining products of breakdown of the U nucleus is described. A Cs isotope of half-life ~40 sec. has been obtained from a short-lived Xe isotope, and a corresponding Rb isotope of half-life ~80 sec. has been produced from a Kr isotope. The Sr isotopes of half-life 6 hr. and 54 days respectively, formerly regarded as the primary breakdown products, are produced from Kr isotopes. A. J. M.

Application of the "emanation capacity" of thorium hydroxide to the production of transmutation products of thorium. O. HAHN and F. STRASSMANN (Naturwiss., 1940, **28**, 61).—Cs of half-life 40 sec. and Rb of half-life 80 sec. were found among the transmutation products of Th. A. J. M.

Nuclear fission of separated uranium isotopes. A. O. NIER, E. T. BOOTH, J. R. DUNNING, and A. V. GROSSE (Physical Rev., 1940, [ii], **57**, 546).—The isolation, by means of a mass spectrometer, of isotopes 238 and 235 from U ions produced by electron collisions with mols. of low-pressure vapour from heated UBr_4 is described. The rate of fission of the separated ^{235}U, investigated by bombardment with neutrons from a cyclotron, is in good agreement with the val. obtained from unseparated isotopes. Results support the view that ^{235}U is responsible for slow neutron fission as predicted by theory (cf. Bohr, A., 1940, I, 53). On this basis the cross-section for fission is ~400—500×10^{-24} sq. cm. The possible effect of ^{234}U, present to ≯1 in 17,000, is negligible. N. M. B.

Fission products of uranium. E. SEGRÈ and C. S. WU (Physical Rev., 1940, [ii], **57**, 552).—U was bombarded with neutrons from a cyclotron, and in an investigation of fission products 5-day period Xe (cf. Langsdorf, A., 1939, I, 505) arising from 22-hr. I (cf. Abelson, *ibid.*, 504) was identified. The complete chain is Sb (10 min.) → Te (60 min.) → I (22 hr.) → Xe (5 days), and a new chain Te (~15 min.) → I (6·6 hr.) → Xe (9·4 hr.) was found. The same chains were observed for Th bombardment. Mo (67-hr.) is confirmed (cf. A., 1939, I, 350) by the extraction of the characteristic 6·6-hr. activity of element 43 from the Mo produced by fission. N. M. B.

Electrons arising from the disintegration of cosmic-ray mesotrons. B. ROSSI (Physical Rev., 1940, [ii], **57**, 469—471).—Mathematical. A simple theoretical expression is deduced for the ionisation produced by the electrons arising from the disintegration of cosmic-ray mesotrons. N. M. B.

Spontaneous disintegration of the neutral mesotron (neutretto). S. SAKATA and Y. TANIKAWA (Physical Rev., 1940, [ii], **57**, 548; cf. Tuve, A., 1937, I, 5).—Mathematical. A rough estimate gives a val. for the lifetime of the neutral mesotron at rest $\sim 10^{-10}$ times that of the charged mesotron. This result seems to explain the failure of experiments to prove the existence of the neutral mesotron in cosmic rays. N. M. B.

Variation of the hard component of cosmic rays with height and the disintegration of mesotrons. B. ROSSI, N. HILBERRY, and J. B. HOAG (Physical Rev., 1940, [ii], **57**, 461—469).—The vertical intensity of the hard component was measured at different altitudes with and without a graphite layer above the threefold coincidence counter. The counting rate under a given mass of air + C was ≫ that under the same mass of air alone. The difference is interpreted as due to the spontaneous decay of the mesotrons forming the hard component. N. M. B.

Intensity variation of the hard component of cosmic ultra-radiation. W. RAU (Z. Physik, 1939, **114**, 265—296).—Results of intensity measurements under 40 m. of H_2O, extending over a period of 15 months, are given. L. G. G.

Directional distribution and penetrating power of radiation produced from ultra-radiation impacts. G. Rakuttis (Z. Physik, 1939, **114**, 318—341).—Absorption and distribution measurements are made on the radiation from Fe using an ionisation chamber and variably placed counter tubes.
L. G. G.

Double and triple coincidences with ultra-radiation impacts. E. Stuhlweissenburg (Z. Physik, 1939, **114**, 297—317).—The mean range of impact particles from Pb and Fe is determined by absorption measurements with two ionisation chambers, a third chamber serving to measure the angular distribution. L. G. G.

Second maximum in the Rossi transition curve for copper. P. J. G. de Vos (Nature, 1940, **145**, 387).—A second max. in the transition curve for cosmic-ray secondaries from Cu similar to that from Pb has been established. L. S. T.

Cosmic-ray particles at great depth. J. Barnóthy and M. Forró (Physical Rev., 1940, [ii], **57**, 552).—An erratum (cf. A., 1939, I, 351).

Nuclear electron showers. A. W. Stern (Physical Rev., 1940, [ii], **57**, 339—340).—An examination of evidence, from the work of a no. of investigators, as to whether the presence of heavy particles in the large air showers may be ascribed to some process separate from and less frequent than the usual cascade shower.
N. M. B.

Simultaneous penetrating particles in cosmic radiation. G. Wataghin, M. D. de S. Santos, and P. A. Pompeia (Physical Rev., 1940, [ii], **57**, 339).—Measurements to obtain evidence on the no. of penetrating particles and the size of showers previously reported (cf. A., 1940, I, 91) are described. Using a fivefold coincidence set, the frequency found for fivefold coincidences is $\sim 5 \times 10^{-4}$ per min. (indicating the existence of showers containing at least 3 particles), or $\sim 15\%$ of the frequency of fourfold coincidences. The average no. of particles in the observed showers is ~ 15. N. M. B.

Simultaneous penetrating rays from the atmosphere. V. Josephson, D. K. Froman, and J. C. Stearns (Physical Rev., 1940, [ii], **57**, 335).—In view of the suggestion by Nordheim (cf. A., 1939, I, 593) that mesotrons may be produced by multiple processes in the atm., an experiment similar to that of Wataghin *et al.* (cf. A., 1940, I, 91) is described. Since coincidence rates are ~ 100 times the expected random rate, results confirm previous observations of simultaneous penetrating rays, and indicate that only a small fraction of the coincidences can be due to simultaneous rays arising at the great heights at which most mesotrons are thought to be produced.
N. M. B.

Correlation between cosmic-ray intensity and upper air pressures and temperatures. N. F. Beardsley (Physical Rev., 1940, [ii], **57**, 336—337).—Data for altitudes up to $\sim 14{,}000$ m. of observations taken over a year are plotted and discussed.
N. M. B

Cloud chamber photographs of cosmic rays up to 29,300 feet. G. Herzog (Physical Rev., 1940, [ii], **57**, 337).—In 110 Wilson chamber photographs taken above 20,000 ft., >25 tracks were interpreted from density and momentum as due to mesotrons. There was evidence of stronger ionising particles, possibly due to protons, α-particles, or heavier nuclei.
N. M. B.

Intensity-variations of cosmic ray. C. Ishii, Y. Asano, Y. Sekido, and H. Simamura (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 1066—1087).—Cosmic-ray data collected at Tokyo from Jan., 1937, to July, 1938, have been analysed statistically. The cosmic-ray intensity varies irregularly with the atm. pressure. The temp. effect of $-0{\cdot}15\%$ per degree, obtained from the seasonal variation with amplitude 2%, leads to $2{\cdot}6 \times 10^{-6}$ sec. for the life-time of the meson. W. R. A.

Absolute value of cosmic-ray ionisation at sea level in different gases. J. Clay (Rev. Mod. Physics, 1939, **11**, 123—127).—Data for ionisation in N_2, A, Kr, and Xe for various fields, saturation vals. by extrapolation, and saturation vals. at different pressures are plotted and results are considered with the aid of the Jaffé–Zanstra theory. Ionisation by cosmic rays and by γ-rays is compared, relation of ionisation to gas density and screening is examined, and vals. are compared with available and calc. data. Ionisation in open air is $1{\cdot}63 \pm 0{\cdot}05$ ions per c.c. per sec. at 760 mm. N. M. B.

Intensity of cosmic radiation under thick layers. J. Clay (Rev. Mod. Physics, 1939, **11**, 128—135).—Extensive data tabulated and plotted for the decrease of intensity under various thicknesses of different material and a consideration of secondaries and showers at different depths lead to the conclusion that the most penetrating component may be due to protons rather than to mesotrons or electrons.
N. M. B.

Stable periodic orbits in the theory of primary cosmic radiation. A. Baños, jun., H. Uribe, and J. Lifshitz (Rev. Mod. Physics, 1939, **11**, 137—148).—Mathematical. Computations on the characteristic exponents of the inner (stable) periodic orbits are reported. The motion of a charged particle in the field of a magnetic dipole is considered only in its own meridian plane. N. M. B.

Fine-structure pattern of directional cosmic-ray intensity. E. J. Schremp and H. S. Ribner (Rev. Mod. Physics, 1939, **11**, 149—152; cf. A., 1939, I, 445).—A summary of theoretical and experimental investigations supports the view that the fine-structure patterns offer a direct method of analysis of primary cosmic rays, their energy spectra, and their absorptive properties. N. M. B.

Significance of variations in cosmic-ray intensity and their relation to solar, electromagnetic, and atmospheric phenomena. V. F. Hess (Rev. Mod. Physics, 1939, **11**, 153—157).—The proved existence of regular and irregular variations of cosmic-ray intensity with time, part of these occurring simultaneously at points over the entire globe, is evidence of the extra-terrestrial origin of the rays and leads to conclusions on the relationship

of cosmic-ray intensity with solar and geomagnetic phenomena. N. M. B.

Variations of cosmic-ray intensity with variations of barometric pressure and temperature at sea level. J. CLAY and E. M. BRUINS (Rev. Mod. Physics, 1939, **11**, 158—159).—The records of three ionisation chambers, two under 110 cm. of Fe and one under 12 cm. of Fe, show, only for the last-named, a daily influence generally parallel to temp., and only in winter. A long-period variation with temp. (generally antiparallel) and with pressure is the same in all three instruments. A barometric coeff. (inexplicably high) of $-6\cdot4\%$ per cm. Hg, and a temp. coeff. of $-0\cdot21\%$ per degree, are found. N. M. B.

Present status of solar and sidereal time variation of cosmic rays. E. O. WOLLAN (Rev. Mod. Physics, 1939, **11**, 160—165).—A consideration of experimental data shows that a solar diurnal variation is well established but a sidereal diurnal variation has not been proved. N. M. B.

Seasonal studies [of cosmic rays] at high altitudes. W. P. JESSE (Rev. Mod. Physics, 1939, **11**, 167).—Automatic recordings by balloons carrying an ionisation chamber and special type of electrometer give evidence of intensity variations with pressure but seasonal variations are not conclusively established. N. M. B.

Recurrence phenomena in cosmic-ray intensity. A. T. MONK and A. H. COMPTON (Rev. Mod. Physics, 1939, **11**, 173—179; cf. Gill, A., 1939, I, 236).—Chree's method of investigation applied to daily mean intensities leads to the conclusion that the high correlation between the intensity of cosmic-ray ionisation at one time and that about one synodic rotation of the sun later is a recurrence, but not necessarily a true periodic phenomenon, although there is a possibility of the latter. N. M. B.

World-wide periodic variations of the intensity of cosmic radiation. M. S. VALLARTA and O. GODART (Rev. Mod. Physics, 1939, **11**, 180—190).—A theoretical treatment of the solar diurnal, sidereal diurnal, seasonal, and the 27-day period variations of intensity shows that they can be accounted for largely on the hypothesis of a permanent field of the sun, although the discrepancy remains of a 3-months phase difference between observed and calc. seasonal variation. N. M. B.

Nature of cosmic-ray particles. S. H. NEDDERMEYER and C. D. ANDERSON (Rev. Mod. Physics, 1939, **11**, 191—207).—A review of experimental evidence which has contributed to knowledge of the nature and mode of absorption of cosmic-ray particles. The difficulties which led to the hypothesis of a particle (mesotron) of mass intermediate between that of the electron and proton are described. N. M. B.

Evidence that protons are the primary particles of the hard component [of cosmic rays]. T. H. JOHNSON (Rev. Mod. Physics, 1939, **11**, 208—210).—A survey of available evidence. N. M. B.

Specific ionisation of high-speed particles. R. B. BRODE (Rev. Mod. Physics, 1939, **11**, 222—229).—The theory of and available data for ionisation by cosmic rays are reviewed. A consistent picture of sea-level cosmic radiation is obtained if it is assumed that all particles in the $H\rho$ distribution $<\sim 10^5$ are electrons (ρ = radius of curvature of the particle in a magnetic field H), between 10^5 and 10^6 both electrons and mesotrons are found, and above 10^6 most of the particles are mesotrons. N. M. B.

Nature of cosmic rays below ground. V. C. WILSON (Rev. Mod. Physics, 1939, **11**, 230—231; cf. A., 1938, I, 225; 1939, I, 175).—Experiments indicate the existence of two types of very penetrating rays at great depths, one with 250—400 m. max. range, and one with a much greater range. Evidence as to the nature of the rays is inconclusive. N. M. B.

Deep [cosmic] rays. P. AUGER and T. GRIVET (Rev. Mod. Physics, 1939, **11**, 232—234).—Experiments with counters, one of which is protected against secondaries, are described. Evaluations of energy based on the Rossi curves and on decoherence measurements agree with the most recent theoretical vals. A large proportion of soft rays, with a wide distribution which is probably due to the numerous showers, was observed. The deep rays seem to be characterised by their rapid filtration with depth. N. M. B.

Energy distribution and positive excess of mesotrons. H. JONES (Rev. Mod. Physics, 1939, **11**, 235—238).—Measurements of penetrating cosmic rays near sea level with a vertical cloud chamber controlled by a threefold coincidence counter are described. The energy spectrum in the region $0\cdot2 \times 10^3$—2×10^3 Me.v. is compared with available data and with theory. Throughout the range an excess of $\sim 29\%$ more positive mesotrons than negatives was found. N. M. B.

Energy spectrum of primary cosmic rays. M. S. VALLARTA (Rev. Mod. Physics, 1939, **11**, 239—240).—The basis of a projected experiment, satisfying special requirements, for an investigation of the primary spectrum through the azimuthal effect is discussed. N. M. B.

Showers produced by penetrating rays and allied phenomena. W. F. G. SWANN (Rev. Mod. Physics, 1939, **11**, 242—254).—A complex arrangement of Pb shields, banks of counters, and 180 electroscopes for recording shower phenomena is described, and preliminary results are reported. Views, initiated by intensity zenith angle and intensity altitude observations, on the nature of cosmic-ray phenomena in the stratosphere are discussed. N. M. B.

Behaviour of high-energy electrons in the cosmic radiation. C. G. MONTGOMERY and D. D. MONTGOMERY (Rev. Mod. Physics, 1939, **11**, 255—266).—Electrons from the disintegration of mesotrons are of equal importance to the cascade electrons in the production of large bursts of cosmic-ray ionisation. Large showers from Pb and showers of a few rays are accounted for by the action of electrons and photons from the same source. It is suggested that showers of heavily ionising particles, or nuclear vaporisations, are produced by electrons and photons

in the same energy range as those which produce the large bursts. There is evidence that the neutrons in cosmic radiation at sea level are produced in the nuclear vaporisation process. N. M. B.

Burst frequency as a function of energy. M. Schein and P. S. Gill (Rev. Mod. Physics, 1939, **11**, 267—276).—Size-frequency distributions of bursts obtained by analysis of records made by Carnegie cosmic-ray meters shielded by Pb, at different locations, indicate that at least the greater part of the burst-producing radiation at sea level consists of penetrating ionising rays, probably mesotrons. Data for creation probability of bursts are given, and the high burst rates at high altitudes are accounted for by assuming that some of the largest bursts are created by photons or electrons of energies $>10^{11}$ e.v. This suggests a possible mechanism for the creation of mesotrons by the soft component in the earth's atm. N. M. B.

Recent experiments on cosmic rays. P. M. S. Blackett and B. Rossi (Rev. Mod. Physics, 1939, **11**, 277—281).—A preliminary account of experiments on shower production by penetrating rays, origin of the ionisation bursts, absorption of penetrating particles in Au, and the non-ionising component of cosmic rays. N. M. B.

Narrow cosmic-ray showers. W. Bothe (Rev. Mod. Physics, 1939, **11**, 282—287).—The particles in such showers are of penetrating type and are interpreted as medium- and low-energy mesotrons. The no. of rays per hard shower is ~ 2. Results can be explained tentatively by assuming production of secondary mesotrons of medium or low energy by the fast mesotrons of the hard cosmic-ray component. N. M. B.

Extensive cosmic-ray showers. P. Auger, [with P. Ehrenfest, R. Maze, J. Daudin, Robley, and A. Fréon] (Rev. Mod. Physics, 1939, **11**, 288—291).—Experiments showing the existence in the showers of particles of energies up to 10^{15} e.v. are reported. Such particles cannot be due to a single process, and most probably acquire their energy along electric fields of very great extension. N. M. B.

Mesotron production in the atmosphere. M. Schein and V. C. Wilson (Rev. Mod. Physics, 1939, **11**, 292—295).—Experiments in an aeroplane up to 25,000 ft. with counters arranged for fourfold vertical coincidence show that an average of 2 ionising penetrating particles (mesotrons) per min. were ejected in the forward direction from a Pb plate by the action of non-ionising rays (photons). This leads to a cross-section in rough agreement with theory for the production of mesotrons by photons. N. M. B.

Disintegration of mesotrons. B. Rossi (Rev. Mod. Physics, 1939, **11**, 296—303).—The variation of the hard cosmic-ray component with zenith angle and the temp. effect suggest that the cosmic mesotrons decay with a lifetime of $\sim 3 \times 10^{-6}$ sec. There is no evidence that mesotrons which have been stopped disintegrate into an electron and a neutrino. N. M. B.

Energy losses of fast mesotrons and electrons in condensed materials. O. Halpern and H. Hall (Physical Rev., 1940, [ii], **57**, 459—460; cf. Fermi, A., 1940, I, 91).—Mathematical. A density-dependence of the collision cross-section for energy losses can be described with reference to certain limiting cases for a model containing two dispersion frequencies rather than a single type of dispersion electrons. N. M. B.

Ionisation loss of energy in gases and in condensed materials. E. Fermi (Physical Rev., 1940, [ii], **57**, 485—493).—Mathematical. The loss of energy of a fast charged particle due to the ionisation of the material traversed is markedly influenced by the density of the material by reason of the alteration of the electric field of the particle by the electric polarisation of the medium. A theory based on classical electrodynamics shows that, for equal mass of material traversed, the loss is larger in a rarefied than in a condensed substance. Results are discussed with reference to the difference of absorption of cosmic-ray mesotrons in air and in condensed material as evidence of spontaneous decay of the mesotron. N. M. B.

***p*-Wave anomalies in proton–proton scattering.** G. Breit, C. Kittel, and H. M. Thaxton (Physical Rev., 1940, [ii], **57**, 255—259; cf. A., 1939, I, 395).—Mathematical. The *p*-wave effects on Bethe's neutral form of meson theory (cf. *ibid.*, 447) are calc. for 2—3-Me.v. proton energies. Comparison of theoretical and experimental angular distributions indicates that *p*-wave effects predicted on the assumption that the meson mass is 180 electron masses are too large since they give too much small-angle scattering. N. M. B.

Nuclear excitation of lead by *X*-rays. B. Waldman and G. B. Collins (Physical Rev., 1940, [ii], **57**, 338—339; cf. A., 1939, I, 233).—Since metastable states may have been excited but not observed owing to the absorption of the low-energy internally converted electrons by the counter walls, counters were constructed with the investigated metal forming the cylindrical cathode. After irradiation with 1·5-Me.v. electrons a Pb counter showed a $1{\cdot}6 \pm 0{\cdot}2$-min. activity. An excitation curve for this activity gave a threshold of $0{\cdot}65 \pm 0{\cdot}02$ Me.v., corresponding with the lowest activation level. Assuming that the radiation emitted is mainly internally converted electrons, the upper and lower energy limits were determined as 250 and ~ 150 kv., respectively. N. M. B.

Meson theory of nuclear forces. I. General theory. II. The deuteron. H. A. Bethe (Physical Rev., 1940, [ii], **57**, 260—272, 390—413).—Mathematical. A detailed development of the neutral theory of the deuteron. It is shown comparatively that the numerical results of the symmetrical theory are wholly unsatisfactory. N. M. B.

Electromagnetic self-energy of mesotrons. R. D. Richtmyer (Physical Rev., 1940, [ii], **57**, 413—416; cf. Weisskopf, A., 1939, I, 507).—Mathematical. The calc. self-energy is separated into its various parts, the divergences of which are considered. N. M. B.

Statistical behaviour of known and unknown elementary particles. W. PAULI and F. J. BELINFANTE (Physica, 1940, 7, 177—192).—Mathematical.
L. J. J.

Relativistic magnetic moment of a charged particle. H. MARGENAU (Physical Rev., 1940, [ii], 57, 383—386).—Mathematical. Formulæ for the magnetic moment of a particle moving rapidly in a central field of force are derived, and possible nuclear applications, particularly to the problem of the deuteron, are discussed. In view of the increased accuracy of measurements of moments, the relativity effect appears to be of measurable magnitude.
N. M. B.

Deviation from the Coulomb law for a proton. W. E. LAMB, jun. (Physical Rev., 1940, [ii], 57, 458; cf. A., 1939, I, 547).—A mathematical discussion (cf. Fröhlich *et al.*, A., 1940, I, 5). N. M. B.

The statistical method in nuclear theory. K. FUCHS (Proc. Roy. Soc., 1940, A, 174, 509—522). —A generalisation of the statistical method for the calculation of nuclear energies is given, which makes it possible to dispense with the Hartree approximation of independent wave functions. The two directions of spin are considered separately and general expressions for the energy of nuclei with any spin are derived.
G. D. P.

Calculation of nuclear energies and stability by the statistical method. B. SPAIN (Proc. Roy. Soc., 1940, A, 174, 523—545).—Nuclear energies and radii are calc. using the statistical method (cf. preceding abstract) and good agreement with experiment is obtained. The stability of nuclei is investigated by a calculation of the max. and min. vals. of the isotopic no.; for the odd nuclei good agreement with experiment is found but for the even nuclei the agreement is not so satisfactory. G. D. P.

Repulsive forces between isotopic molecules. R. P. BELL (Proc. Roy. Soc., 1940, A, 174, 504—509).—A theoretical investigation leads to the conclusion that the effect of nuclear mass should cause a measurable difference between the second virial coeffs. of H_2 and D_2. G. D. P.

Excited states of the ^{16}O nucleus. D. M. DENNISON (Physical Rev., 1940, [ii], 57, 454—456; cf. Fowler, A., 1940, I, 4).—Mathematical. An examination of the levels of ^{16}O, as predicted by the α-particle model, with reference to the requirements postulated by Oppenheimer (cf. *ibid.*, 52).
N. M. B.

Determination of the Rydberg constants, e/m, and the fine structures of H_α and D_α by means of a reflexion echelon. J. W. DRINKWATER, (SIR) O. RICHARDSON, and W. E. WILLIAMS (Proc. Roy. Soc., 1940, A, 174, 164—188).—Wave nos. were determined by means of a 40-plate reflexion echelon for the main lines of H_α and D_α. m of the electron is $(5{\cdot}48648 \pm 0{\cdot}0005) \times 10^{-4}$ at. unit, $e/m = (1{\cdot}7591 \pm 0{\cdot}0004) \times 10^7$ e.m.u. per g., $M_H/m = 1837{\cdot}4$, and $R_\alpha = 109737{\cdot}27$. The observed fine structure is in agreement with the vals. calc. from Dirac's equations.
G. D. P.

General relation between the elementary charge and the quantum of energy. J. FUCHS (Ann. Physik, 1939, [v], 36, 621—624).—Theoretical. $h = e^2 . z_H/2$, where z_H is identified as the wave resistance in the region of the Bohr H model.
O. D. S.

Transparency of the atmosphere. VI. White mist. J. DUCLAUX (J. Phys. Radium, 1940, [viii], 1, 41—43; cf. A., 1939, I, 596).—The coeff. of atm. absorption can be represented as the sum of two terms, one of mol. diffusion and the other, which is independent of λ, corresponds with a white mist. This mist obscures objects without modifying their colour. It has an exceptional character; in most instances the effects obtained by photography with coloured filters and by visual observation indicate that the mist shows increased absorption as λ decreases. The decomp. of the atm. absorption into the above two terms is a qual. hypothesis and quant. conclusions cannot be drawn. W. R. A.

Predissociation phenomena in the spectrum of aluminium hydride. B. GRABE and E. HULTHÉN (Z. Physik, 1939, 114, 470—477). L. G. G.

Predissociation of several diatomic molecules. G. HERZBERG and L. G. MUNDIE (J. Chem. Physics, 1940, 8, 263—273).—The anomalous intensity distribution in S_2 bands indicates that the dissociation limit for the first predissociation lies well below the predissociation limit (4·4 ev.). The anomalous intensity and the diffuseness persist at very low pressures (0·01 mm.), indicating that it is not pressure-broadening (cf. Lochte-Holtgreven, A., 1937, I, 1) but true predissociation. The second predissociation of S_2 starting with the 18—0 band gives an upper limit of 3·6 ev. for the heat of dissociation of S_2. A similar anomalous intensity distribution is found for NO assuming that the ε absorption bands are a continuation of the γ bands. This indicates a predissociation in the upper $^2\Sigma$ state of the γ bands into normal atoms with a limit 1·3 ev. > the dissociation limit. The intensity distribution found by Schüler *et al.* in the CuH emission band 4280 A. at low pressure (A., 1939, I, 177) is attributed to a predissociation into the $^3\Sigma^+$ state derived from normal Cu (^2S) and normal H (^2S); such a state cannot cause predissociation of the level $J' = 0$, in agreement with observation. The heat of dissociation of CuH is $<23{,}325$ cm.$^{-1}$ (2·892 ev.). The method suggested previously (cf. A., 1939, I, 354) for the detection of max. of potential curves has been applied to AlD (AlH) and BH. The breaking-off points observed in the visible bands of these mols. show that their $^1\Pi$ states have potential curves with max. Thus the dissociation energies are < the energies of the observed breaking-off points, *i.e.*, D_0 (AlH) $<24{,}775$, D_0 (AlD) $<25{,}010$, D_0 (BH) $<28{,}350$ cm.$^{-1}$ W. R. A.

Absorption coefficient of nitrogen dioxide in the visible. J. K. DIXON (J. Chem. Physics, 1940, 8, 157—160).—NO_2 obeys Beer's law at all visible λλ at pressures up to 70 mm. Hg. The curve of absorption coeff. against λ shows sinusoidal fluctuations over the whole range, with a const. separation of 700 ± 100 cm.$^{-1}$ between adjacent max., and a difference of ~10% in intensity between adjacent max. and min.
L. J. J.

Aluminium monoxide bands. D. Roy (Indian J. Physics, 1939, **13**, 231—240).—The bright band spectrum of AlO emitted by the Al arc in the region 4100 to 5700 A. has been re-examined, the Al arc being operated in air at 220 v. d.c. and $\not> 8$ amp. 14 new bands have been observed. *O–C* (cm.$^{-1}$) vals. have been calc. using a new equation $\nu_e = 20699{\cdot}25 + 870(v' + \frac{1}{2}) - 3{\cdot}8(v' + \frac{1}{2})^2 - 978{\cdot}2(v'' + \frac{1}{2}) + 7{\cdot}12(v'' + \frac{1}{2})^2$ and are compared with the vals. obtained using Mecke's equation. Using the new data, the energy of dissociation of AlO in the lower and upper electronic states of the band system is 4·03 and 6·04 v. respectively, compared with 4·15 and 6·15 v. respectively calc. by Lessheim and Samuel from old data (cf. A., 1933, 996). W. R. A.

Isotope effect in the band spectrum of tin monoxide. P. C. Mahanti and A. K. Sengupta (Indian J. Physics, 1939, **13**, 331—347).—The (0, 1) band of the *A* system of SnO has been photographed in the first and second orders of a 21-ft. concave grating and evidence for lines due to isotopes of mass 116, 118, 120, 122, and 124 has been obtained. No trace of lines arising from isotopes of mass 117 and 119 occurred although, according to mass spectral data, their relative abundance is > that of isotopes 122 and 124. W. R. A.

Diffuse band system of the selenium dichloride molecule. M. Wehrli (Helv. Phys. Acta, 1936, **9**, 637—639; Chem. Zentr., 1937, i, 3598—3599; cf. A., 1939, I, 401).—The spectrum of $SeCl_2$ has been studied by heating Se_2Cl_2 (temp. θ_s) in a 10-cm. quartz absorption tube (temp. θ_t) coated with metallic Se. With $\theta_s = 80°$ and $\theta_t = 150°$, four diffuse structureless bands occur in the greenish-blue; these become stronger and eventually develop into a continuum as θ_s or θ_t is raised. As θ_s is increased above 240°, bands again develop on the long-λ side owing to quantisation of the ground state, and at 460° 16 diffuse bands occur. A. J. E. W.

Band spectrum of MnF. G. D. Rochester and E. Olsson (Z. Physik, 1939, **114**, 495—499).—The nuclear vibration analysis of the MnF absorption bands is given. L. G. G.

Intensity of the $^3\Pi$—$^1\Sigma$ Cameron bands of carbon monoxide. G. E. Hansche (Physical Rev., 1940, [ii], **57**, 289—291).—Conditions influencing the intensity were studied in detail, using the electrodeless ring discharge. The bands are intense in a large discharge tube at a pressure of $\not> \sim 0{\cdot}005$ mm. when the mean free time between collisions of CO mols. is $2{\cdot}5 \times 10^{-5}$ sec., giving an estimated lifetime of $\sim 10^{-5}$ sec. for the $^3\Pi$ state. Marked increases of intensity relative to that of other band systems in the same spectral region are produced by increasing the energy of the discharge and by lowering the pressure, indicating that the excitation function of the Cameron system differs significantly from those of the systems with which it is compared. N. M. B.

Absorption spectra of phosphorus compounds. S. N. Ali (Indian J. Physics, 1939, **13**, 309—319).—Examination of the spectra of solutions of HPO_3, H_3PO_4, $H_4P_2O_7$, K_3PO_4, K_2HPO_4, KH_2PO_4, and K_2HPO_3 and of the vapours of HPO_3, H_3PO_4, and KPO_3 shows that there is no essential difference in behaviour or structure between the acids, salts, and esters of P and N (cf. A., 1936, 920). W. R. A.

Oxyhalides of the rare earths and their reflexion spectra. Oxychlorides of the cerides. L. Mazza and A. Iandelli [with E. Botti] (Gazzetta, 1940, **70**, 57—72).—The prep. of MOCl (M = La, Pr, Nd, Sm) is described. *X*-Ray measurements show that these compounds can exist in two forms. The reflexion spectra of the oxychlorides and of the corresponding oxides and chlorides in the region 4000—7000 A. have been measured and compared. O. J. W.

Lattice vibrations of crystals and the corresponding vibrations of their solutions. S. I. Weissman and S. Freed (J. Chem. Physics, 1940, **8**, 227—228).—Crystals of hydrated Eu chloride show faint repetitions of the main absorption lines on both long- and short-λ sides of the main spectrum at room temp., but only on the latter side at liquid N_2 temp. The intervals correspond with the lattice frequencies 115 cm.$^{-1}$ and 127 cm.$^{-1}$ Similar repetitions in a diffuse form are given by solutions up to 1·7M. L. J. J.

Absorption spectra of ethylene, deuteroethylene, and some alkyl-substituted ethylenes in the vacuum ultra-violet. W. C. Price and W. T. Tutte (Proc. Roy. Soc., 1940, **A**, **174**, 207—220).—Absorption bands in the region 1000—2000 A. of C_2H_4, C_2D_4, and C_2H_3D are ascribed to excitation of the π electrons of the double bond. The spectra of C_3H_6, Δ^{β}-butene (*trans*), *cyclo*hexene, C_2HMe_3, and C_2Me_4 are shifted to longer λλ with reduction of ionisation potential. The results are compared with the spectra of the dichloroethylenes. G. D. P.

Absorption spectra of conjugated dienes in the vacuum ultra-violet. W. C. Price and A. D. Walsh (Proc. Roy. Soc., 1940, **A**, **174**, 220—234).—The spectra of $(CH_2{:}CH)_2$, isoprene, $(CH_2{:}CMe)_2$, and chloroprene were investigated in the region 1000 to 2500 A. and were found to be very similar. Mol. ionisation potentials are deduced. G. D. P.

Fluorescence and absorption spectra of anthracene and phenanthrene in solutions. S. Sambursky and G. Wolfsohn (Trans. Faraday Soc., 1940, **36**, 427—432).—Fluorescence spectra of anthracene in C_6H_{14}, MeOH, C_6H_6, PhMe, and PhCl show a const. spacing of 1380 cm.$^{-1}$, corresponding with the totally symmetrical Raman frequencies. The same is true of phenanthrene (I) in C_6H_6 and in MeOH. Both substances show also a secondary spacing which cannot be correlated with a known Raman or infra-red frequency. (I) has two excited levels differing by 630 cm.$^{-1}$ The frequency of the (*o*, *o*) absorption bands is > that of the corresponding fluorescence bands. F. L. U.

Change of the ultra-violet absorption spectrum of acraldehyde with time. A. M. Buswell, E. C. Dunlop, W. H. Rodebush, and J. B. Swartz (J. Amer. Chem. Soc., 1940, **62**, 325—328).—Solutions of acraldehyde (I) in H_2O and in 50% EtOH have been examined at 7-day intervals over a period of time. Initially there are two bands at 3200 cm.$^{-1}$

(due to C:O) and at somewhat <2590 A. (C:C). After a few days a new band appears at 2670 cm.$^{-1}$ which increases with time whilst the C:O band disappears. The 2670 A. band does not show up so strongly in the presence of an anti-oxidant (quinol, tannic acid). Solutions of EtCHO in H_2O and 50% EtOH, of acetal in H_2O, and of paraldehyde and of aldol in 50% EtOH give spectra quite different from that of (I), indicating that none of these substances is formed. CH_2:CH·CO_2H is not formed because there is no change in p_H. The 2670 A. band appears to be due to the C:O group of the polymeride formed in the polycondensation of (I) (cf. Gilbert and Donleavy, A., 1938, II, 393). W. R. A.

Ultra-violet absorption spectrum of paraffins and vaselines. E. VELLINGER and B. THOMAS (Compt. rend., 1940, **210**, 296—297).—The absorption at 2000—4000 A. of cryst. paraffins extracted from petroleum is $\gg$ that of products from which aromatic compounds have been removed by treatment with oleum. Vac. distillation of vaselines also gives fractions with high absorption, that of the solid residue being still higher; less absorptive fractions are obtained from the oil extracted from vaseline by C_2HCl_3. As paraffin hydrocarbons do not absorb in the λ range given, the products studied probably contain highly substituted aromatic compounds. A. J. E. W.

Relation between absorption spectra and chemical constitution of dyes. XV. Influence of sulphonic acid groups in aminoazo-dyes.—See A., 1940, II, 165.

Ultra-violet absorption spectrum of prolactin. —See A., 1940, III, 405.

Steric influence in optically sensitising dyes. S. E. SHEPPARD, R. H. LAMBERT, and R. D. WALKER (Nature, 1940, **145**, 386).—The presence of steric inhibition of co-planarity in certain of the cyanine dyes prepared by Brooker *et al.* (A., 1936, 739) is discussed. It is regarded as a cause of modified spectral absorption, and inefficiency of optical sensitisation of Ag halides (cf. A., 1938, I, 151). L. S. T.

Peroxidase action of π-aldehydocamphor.— See A., 1940, II, 136.

Infra-red spectra (2·5—7·5 μ.). Absorption of water. J. J. FOX and A. E. MARTIN (Proc. Roy. Soc., 1940, **A, 174**, 234—262).—The absorption spectrum of H_2O in the vapour, liquid, and solid states was investigated; in the liquid and solid the variation of the absorption bands with change of temp. was studied. The absorption spectrum of water dissolved in CCl_4 was examined; a method of drying CCl_4 is described and a val. obtained for the solubility of H_2O in CCl_4. The mol. extinction coeff. for the vapour is small compared with the val. for liquid and solid in the region 2·7 μ. The results are discussed in relation to the Raman spectrum and structure of liquid and solid H_2O. G. D. P.

Rotational structure of hydrazoic acid bands in photographic infra-red. E. H. EYSTER (J. Chem. Physics, 1940, **8**, 135—142).—The HN_3 bands at 10,477 A. and 8058 A. have been photographed with high dispersion at 0° and 25°, respectively. Rotational consts. in the ground and excited states have been calc. The effective moments of inertia in the ground state are in agreement with the mol. parameters: N_1—H = 1·012 A., N_1—N_2 = 1·241 A., N_2—N_3 = 1·128 A., <HN_1N_2 = 110° 52′. L. J. J.

Spectroscopic evidence for hydrogen bonds: comparison of proton-attracting properties of liquids. II. W. GORDY and S. C. STANFORD (J. Chem. Physics, 1940, **8**, 170—177; cf. A., 1939, I, 178).—Following the method described previously, 42 org. liquids are rated according to the strength of the D bonds formed with MeOD. The proton-attracting power is in the order: esters < aldehydes and ketones < ethers < amines, and is correlated with basicity and solvent power for other proton donor solutes, but not with dipole moment of the solvent. L. J. J.

Complex structure of the O–H harmonic bands of substituted alcohols and the effect of temperature on the relative intensities of the multiplet components. L. R. ZUMWALT and R. M. BADGER (J. Amer. Chem. Soc., 1940, **62**, 305—311).—Fundamental and harmonic O–H bands of alcohols and phenols often consist of two or more components and, when association is precluded, may arise from the presence of two or more mol. species resulting from different mol. configurations which occur owing to restricted rotation about one or more single bonds. If this explanation is valid, (i) a similar pattern should be found in fundamental and harmonic regions with separation of components approx. $\propto$ to the no. of the harmonic, (ii) the relative intensities of components should be dependent on temp., and (iii) individual bands should have different rotational structures. The third harmonic OH band (~10,500 cm.$^{-1}$) of vapours of Cl·$[CH_2]_2$·OH, Br·$[CH_2]_2$·OH, OMe·$[CH_2]_2$·OH, Cl·$[CH_2]_3$·OH and Br·$[CH_2]_3$·OH, CH_2Cl·CHMe·OH, OH·CH(CH_2Cl)$_2$, Pr^{a}OH, and *o*-C_6H_4Cl·OH (I) has been investigated at different temp. Substitution of a halogen or OMe group usually gives rise to one or more new OH bands. For (I) vapour at 180° the energy and free energy of the *trans*-form is > those of the *cis*-form by 3·9±0·7 and 2·8±0·5 kg.-cal., respectively. W. R. A.

Spectroscopic evidence for hydrogen bonds: SH, NH, and NH_2 compounds. W. GORDY and S. C. STANFORD (J. Amer. Chem. Soc., 1940, **62**, 497—505).—Examination of the infra-red spectrum has revealed: that PhSH (i) forms H bonds with C_5H_5N, α-picoline (I), and NH(CH_2Ph)$_2$; (ii) forms a weak H bond with Pr^{β}_2O; (iii) forms no H bonds with NH_2Ph or ethyl-*o*-toluidine (II); (iv) forms white cryst. solids with piperidine (III), *cyclo*hexylamine (IV), and triamylamine; that CH_2Ph·SH forms weak H bonds with CH_2Ph·NH_2 and C_5H_5N and a white cryst. solid with (IV); that Bu^{a}SH forms weak H bonds with C_5H_5N, (I), and (III), and a white cryst. solid with (IV); and that thioacetic acid forms a weak H bond with C_5H_5N but not with Pr^{β}_2O. The spectra of 0·1M-CCl_4 solutions of a no. of compounds containing NH or NH_2 groups have been compared with the spectra of the pure liquids, of conc. solutions in CCl_4, and of solutions in Bu^a_2O. It was found (i) that pyrrole, $NHPh_2$, *o*- and *p*-C_6H_4Me·NH_2, α-

$C_{10}H_7 \cdot NH_2$, o- and m-$C_6H_4Cl \cdot NH_2$ are associated in the pure state and form complexes with $Bu^a{}_2O$ by $NH \rightarrow O$ bonds; (ii) indole is not polymerised but forms a complex with $Bu^a{}_2O$; (iii) (II) neither polymerises nor forms complexes because of steric hindrance; (iv) o-$NH_2 \cdot C_6H_4 \cdot CO_2Me$ and o-$C_6H_4Cl \cdot NO_2$ give evidence of chelation which prevents polymerisation or complex formation; (v) α-$C_{10}H_7 \cdot OH$ is more strongly associated than NH or NH_2 compounds of similar structure. W. R. A.

Infra-red absorption spectrum of methylamine. R. G. OWENS and E. F. BARKER (J. Chem. Physics, 1940, **8**, 229—232).—The NH_2Me mol. approximates to a rigid rotator which is almost, but not quite, axially symmetrical. The parallel band at 10 μ. has been resolved and the centre is at 1045·27 cm.$^{-1}$ with *P* and *R* branches of very regular structure. The moment of inertia in the ground state is $37 \cdot 43 \times 10^{-40}$ g. cm.^{2} and the C—N distance is $1 \cdot 48 \times 10^{-8}$ cm., assuming the angles and distance in NH_2 as in NH_3 and for Me as in CH_4. Bands characteristic of NH_2 and Me could not be resolved. W. R. A.

Vibration spectra and molecular structure. IX. Vapours of fatty acid series. R. C. HERMAN (J. Chem. Physics, 1940, 8, 252—258).—The infra-red spectra of vapours of $PrCO_2H$, $PrCO_2D$, and $BuCO_2H$ have been measured at different temp. and pressure from 1 to 13 μ. The association of HCO_2H, HCO_2D, and $PrCO_2D$ has been investigated in the vapour phase and the bond strengths are 6·2, 6·4, and 6·9 kg.-cal. per mol. per bond. The vals. for HCO_2H and HCO_2D are comparable and were obtained from different bands. The heats of association of HCO_2H obtained from these measurements is < that from vapour density measurements. There appears to be no experimental evidence for a linear relationship between $\Delta\nu/\nu$ and bond strength (A., 1938, I, 60). A linear relationship between the absorption const. of ν(CH) and the no. of C atoms holds for the first five members of the fatty acid series. W. R. A.

Normal vibrations of chains of similar and similarly situated dynamical systems and the infra-red spectrum of undecane. S. E. WHITCOMB, H. H. NIELSEN, and L. H. THOMAS (J. Chem. Physics, 1940, 8, 143—152).—A theory of the vibrations of long chain mols. is developed. Two classes of vibrations are involved, according as the amplitude falls off exponentially from the ends or varies harmonically along the chain. The infra-red spectrum of n-$C_{11}H_{24}$ has been measured from 1 μ. to 15 μ., and found to be in agreement with the theory on the basis of a system of fundamentals, harmonics, and simple combination frequencies. L. J. J.

Infra-red absorption spectrum of phenylmethylacetylene. M. J. MURRAY and F. F. CLEVELAND (J. Chem. Physics, 1940, 8, 133—134).—Data are recorded for absorption by CPh:CMe for 500—2300 cm.$^{-1}$ The spectrum affords no evidence of a fundamental frequency with an overtone responsible for the Fermi resonance splitting of the frequency ~2230 cm.$^{-1}$ L. J. J.

Transmission of glucose glass in the near infra-red. W. M. COHN (J. Chem. Physics, 1940, 8, 232—233).—The transmissions of glucose glasses of varying thermal history have been investigated photographically up to 1·2 μ. (cf. A., 1938, I, 173). W. R. A.

Infra-red absorption spectra of drying oils. D. L. GAMBLE and C. E. BARNETT (Ind. Eng. Chem., 1940, **32**, 375—378).—The absorption spectra of linseed (I), tung (II), and oiticica (III) oils show bands at 3·4, 5·8, 6·9, 8·4, and 11·5 μ.; (II) and (III) also show bands at 10 μ. The effect of pigmentation on the absorption spectrum of (I) is discussed. The 10 μ. band also occurs in the absorption spectra of Me, glycol, and glyceryl (IV) elæostearates, but not in the oleates, linoleates, or linolenates, and hence is attributed to a conjugated double bond system. This 10 μ. band disappears when (IV) is exposed to ultra-violet light for 150 hr., in accordance with the view that the first stage in the drying of (II) comprises rearrangement of the double bonds of (IV). A film of (IV) exposed to ultra-violet light before drying develops high opacity, attributed to polymerisation to large mol. aggregates. J. W. S.

Production of long-wave infra-red radiation. T. ERB and H. KLUMB (Z. Physik, 1939, **114**, 519—524).—No radiation can be detected in the range 100—400 μ. arising from MgO plates irradiated with fast electrons. L. G. G.

Spectral energy distribution of the long-wave infra-red (300 μ.) radiation from various high-pressure discharges. W. DAHLKE (Z. Physik, 1939, **114**, 672—681; cf. A., 1940, I, 50).—A continuation of earlier work. The energy distribution of the Hg high-pressure discharge is compared with that of other forms of emitter, *e.g.*, Hg, Cd, and Zn electrodeless discharges. The distributions are similar and between 150 and 400 μ. are the same as those of black-body radiation. The influence of atm. H_2O on infra-red measurements is discussed. L. G. G.

Absorption correction in the measurement of molecular scattering of light. P. PUTZEYS and E. DORY (Ann. Soc. Sci. Bruxelles, 1940, **60**, 37—44).—An expression correcting the scattering for absorption is calc. from the transmission coeff. of the solution. L. J. J.

α–β transformation of quartz. H. S. ALLEN (Nature, 1940, **145**, 306—307).—The results of Raman *et al.* (A., 1940, I, 152) support the view that at any transition temp., including the m.p., some kind of resonance occurs between two approx. equal frequencies characteristic of the phases concerned. The Sutherland–Lindemann m.p. formula is applicable to the transition point. L. S. T.

Raman spectra of binary silicate glasses. M. F. VUKS and V. A. JOFFE (Bull. Acad. Sci. U.R.S.S., 1938, Cl. Sci. Tech., No. 3, 61—69).—Na glasses have 4, and Pb glasses 2, characteristic Raman lines, not corresponding with those of SiO_2. With rising SiO_2 content the spectra gradually approach that of SiO_2. Na glass has a very intense line 940—960 cm.$^{-1}$, which gradually fades as the SiO_2 content rises, and is ascribed to $Na_2Si_2O_5$. The shift in the spectrum observed as the Pb content is progressively raised corresponds with substitution of Na by Pb atoms. R. T.

Effect of crystal orientation on the Raman spectrum of calcite. S. Bhagavantam (Proc. Indian Acad. Sci., 1940, **11**, **A**, 62—71).—A detailed account of work already noted (A., 1940, I, 95).
W. R. A.

Structure of the ions XO_3'. I. Raman spectra of chlorates and bromates of bivalent cations. M. Rolla (Gazzetta, 1939, **69**, 779—790).—The Raman spectra of solutions of Ca, Sr, Zn, and Cd chlorates and Mg and Zn bromates in H_2O and in org. solvents have been measured. The results support the pyramidal structure of ClO_3' and BrO_3' ions in such solutions.
O. J. W.

Zeeman effect from liquids, solutions of salts of europium. S. Freed, S. I. Weissman, and G. J. Rotariu (J. Chem. Physics, 1940, **8**, 291).—Solutions of Eu salts are unique in the sharpness of their absorption spectra. The absorption lines cluster in groups due to the splitting of the energy levels of the $Eu^{\cdot\cdot\cdot}$ ions by the electric fields of their environment. Further splitting and an increase in the no. of lines are expected when the symmetry of the fields about the ions is reduced by application of an external field. With aq. $Eu(NO_3)_3$, some of the Zeeman components at the fields available have been separated using a three-prism spectrograph of dispersion ~13 A. per mm. at 4650 A. The group of absorption lines at 4650 A. which in absence of the field consists of three lines at 4645·0, 4649·8, and 4654·5 A., increases to five when the radiation passes through the solution transversely to the field. Increase in the field strength causes a component to split off the 4649·8 A. line towards long λλ, until at 33,000 gauss the separation from the undisplaced component was 7±1·5 cm. Another component also separated from the same line to shorter λλ but the displacement was relatively small. The first component represents absorption of radiation with its electrical vector perpendicular to the field; the second component was similarly polarised; the undisplaced component remained unpolarised. The line at 4645·0 A. is displaced by the field to 4644·5 A., but remains unpolarised. The effect of a magnetic field on the spectrum of aq. $EuCl_3$ is very different.
W. R. A.

Raman spectrum of metatungstates in the crystalline state and in aqueous solution. (Mlle.) M. Théodoresco (Compt. rend., 1940, **210**, 297—299).—The following Raman νν (in $cm.^{-1}$) are recorded: $Na_2O,4WO_3,10H_2O$ (in aq. solution), 972—960 (doublet), 941, 897—887, 415, 324, 211; (cryst.) 972, 945, 916, 882—867, 426, 324, 232; cryst. $BaO,4WO_3,nH_2O$, 979, 941, 901, 878, 431, 329, 232. In each case the last three νν are approx., as the lines are diffuse. The νν differ from those for normal tungstates (A., 1940, I, 146), showing that the metatungstates are definite compounds.
A. J. E. W.

Common properties of molecules containing hydrogen. H. Deslandres (Compt. rend., 1940, **210**, 277—281; cf. A., 1940, I, 55).—Raman νν for HN_3, CH⋮CMe, gallic acid, rubber, tyrosine, and raffinose are examined in relation to the mode of excitation of electrons in the mols. Analysis of data for mols. containing H indicates that one or more of the H are activated as units separate from the rest of the mol. Polymerisation occurs in the liquid state.
A. J. E. W.

Raman spectrum and molecular association in formamide. B. D. Saksena (Proc. Indian Acad. Sci., 1940, **11**, **A**, 53—61).—The Raman spectra of pure $HCO\cdot NH_2$ at 25° and 144° and its aq. solutions (25 and 50%) and the state of polarisation of the lines have been determined. 8 new lines for pure $HCO\cdot NH_2$ are reported. Temp. has practically no influence on the spectrum but dilution causes profound changes which are interpreted as changes in the mol. complexity. The mols. appear to be large polymerides with a small amount of the monomeride.
W. R. A.

Intensity of Raman lines in carbon tetrachloride. B. P. Rao (Proc. Indian Acad. Sci., 1940, **11**, **A**, 1—5).—The intensity of a Raman line depends on the variation of the induced optical moment of the mol. with respect to the corresponding normal coordinate and can be calc. For CCl_4 calc. and observed vals. of the intensity and mean polarisability of the symmetrical Raman line of a regular tetrahedral structure are in good agreement. The overtone at 1538 $cm.^{-1}$ is strongly polarised and the fundamental at 780 $cm.^{-1}$ depolarised in agreement with theory.
W. R. A.

Raman effect of symmetrical difluorotetrachloroethane. G. Glockler and C. G. Sage (J. Chem. Physics, 1940, **8**, 291).—22 Raman displacements are reported for *s*-$C_2Cl_4F_2$.
W. R. A.

Raman spectra of simple ethers. F. F. Cleveland, M. J. Murray, H. H. Haney, and J. Shackelford (J. Chem. Physics, 1940, **8**, 153—156).—Frequencies, intensities, and depolarisation factors have been determined for the main Raman lines of Et_2O, *n*- and *iso*-Pr, -Bu, and -amyl ethers. The most intense lines are C–H vibration frequencies near 2900 $cm.^{-1}$, all polarised except one near 2970 $cm.^{-1}$, which is highly depolarised in each case, and C–H deformation frequencies near 1450 $cm.^{-1}$, all highly depolarised.
L. J. J.

Raman effect and chemical constitution. Influence of constitutive and other factors on the double bonds in organic compounds. III. Effect of the benzyl group on the C⁚O bond in esters. G. V. L. N. Murty and T. R. Seshadri (Proc. Indian Acad. Sci., 1940, **11**, **A**, 32—38).—Raman spectra of benzyl esters of AcOH, $EtCO_2H$, BzOH and cinnamic acid, EtOAc, $EtCO_2Et$, EtOBz, $CH_2Ph\cdot CO_2Ph$, and $CH_2Ph\cdot CO_2Et$ have been investigated. The CH_2Ph group influences the C⁚O frequency in the same way as the alkyl groups and quite differently from the Ph group, confirming the view (A., 1940, I, 57) that the electromeric effect is mainly responsible for the influence on the C⁚O frequency and introduction of a CH_2 prevents the transmission of this effect.
W. R. A.

Raman spectra of some thiophen derivatives. A. Simon and O. Kirret (Naturwiss., 1940, **28**, 47—48).—The Raman spectra of 2-bromo-, 2 : 3 : 4- and 2 : 3 : 5-tribromo-, and tetrachloro-thiophen (I) are recorded. The two Br_3-derivatives have different

Raman spectra, and hence are distinct compounds although they have the same m.p., and show no depression of m.p. when mixed. The Raman spectra of both have a weak line at 1600 cm.$^{-1}$, which would indicate the presence of a normal double bond. The line may arise from tautomeric forms. The occurrence of two diffuse lines at 1400 cm.$^{-1}$ in the case of (I) makes the classification of the line of this frequency in the thiophen spectrum as a δ(CH) line doubtful. A. J. M.

Raman spectrum of diphenyl in the solid state. S. A. Aziz (Indian J. Physics, 1939, **13**, 247—252).—The Raman spectrum of solid Ph_2 consists of 26 lines. Compared with the spectrum of liquid Ph_2 (A., 1938, I, 555) some lines are unchanged whilst others are changed in position and intensity. The shifts in position are not all in one direction. Four new low-frequency displacements of 169, 93, 54, and 39 cm.$^{-1}$ are recorded. W. R. A.

Luminescence mechanism of crystalline phosphors. N. Riehl and M. Schön (Z. Physik, 1939, **114**, 682—704).—Theoretical. L. G. G.

Infra-red radiations and their quenching effect on zinc sulphide phosphors. II. G. G. Blake (J. Proc. Roy. Soc. New South Wales, 1939, **73**, 190—205; cf. A., 1940, I, 57).—The effect of low temp. on ZnS screens has been examined. A photographic image can be imprinted by light on a ZnS–Cu screen over a wide range of temp., and then " frozen-in " or suspended by lowering the temp.; the image returns unimpaired when the screen is allowed to regain its original temp. A second image can be frozen in and will reappear at its original temp., thus providing a method for identifying selected temp. levels. At low temp. (—78·2°), infra-red radiations still quench phosphorescence, but the process is retarded. The possibility of using ZnS screens for spark photography is discussed. An unexposed ZnS screen behaves as a slow photographic plate, and an excited screen responds to red light in a manner similar to but slower than a panchromatic plate. L. S. T.

Fluorescence of heavy metal complexes in aqueous solution. P. Pringsheim and H. Vogels (Physica, 1940, **7**, 225—240).—The fluorescence in the visible and ultra-violet excited by light of $\lambda <2500$ A. in Tl, Pb, and Sn salt solutions containing KCl, $CaCl_2$, $MgCl_2$, and HCl, and the corresponding bromides, has been studied. The fluorescence max. of Tl^+ at 3700 A. shifts to 4350 A. and 4600 A., respectively, in the presence of Cl′ and Br′. Weaker bands have max. at 3000 A. with Cl′ and 3200 A. with Br′. The fluorescence and exciting absorption increase together with increasing [Cl′], $CaCl_2$, KCl, and HCl having identical effects up to $\sim$1N. At higher concns. the effect on the emission depends on the cation, H^+ having an extinguishing effect. The intensity of emission relative to the absorption decreases with increasing [Tl^+]. The absorption max. of Tl^+ at 2140 A. is displaced to longer $\lambda\lambda$ by Cl′ ions. Addition of Cl′ to Pb^{++} solutions gives rise to a complex, possibly $PbCl^+$, giving a green fluorescence in the light of an Fe spark, but not excited by the absorption at 2700 A. $SnCl_2$ in saturated aq. KCl absorbs at $<$2700 A., giving a green fluorescence which disappears on continued illumination. L. J. J.

Polarised fluorescence of organic compounds. S. Mitra (Indian J. Physics, 1939, **13**, 349—390).—The variation of the polarisation of some dyes [fluorescein (I), succinylfluorescein, eosin (II), succinyleosin, Magdala-red (III), rhodamine-B (IV), erythrosin, acriflavine, æsculin] and $C_{10}H_7{\cdot}NH_2$, Na salicylate, and o-$NH_2{\cdot}C_6H_4{\cdot}CO_2H$ with change of η of the solution, temp. of the solution, and concn. of the dye has been investigated. The degree of polarisation tends to vanish at low η, or high temp., or high concn. of dyestuff, whilst at very high η, or low temp., or low concn. the polarisation tends asymptotically to a limiting val. which is independent of the nature of the dye, the λ of the exciting radiation, and the nature of the solvent (glycerol, castor oil, collodion–Et_2O, glycerol–H_2O, sugar solution, gelatin–H_2O). The variation of the polarisation with η and temp. is satisfactorily explained by Perrin's theory, but this theory breaks down when applied to the variation of polarisation with concn. of the dye. Polarisation decreases with increase of the λ of the exciting radiation, passes through a min., and then increases as the λ is increased further. The min. val. is negative, and the corresponding λ is characteristic of the dye. As the max. of the fluorescence bands of the dyes shifts to longer $\lambda\lambda$ the position of the max. negative val. of the polarisation shifts in the same direction, in contrast to the observations of Vavilov (A., 1929, 489) for (I)—(IV). Using Perrin's expression, the calc. average life of the dye mols. in the excited state is independent of η, temp., and exciting λ, and this conclusion is substantiated by measurements of the quenching of the fluorescence by foreign substances of various concns.; the quenching by KI is independent of [KI] and of the exciting λ. Therefore all the mols. have the same energy level in the excited state. No general relationship exists between the ultra-violet absorption of the dyes in glycerol and the negative polarisation, but for (I)—(IV) in the λ region which produces the negative polarisation (326—298 mμ.) the absorption coeff. increases, then decreases, and finally increases again as λ decreases. The presence of one dye causes the polarisation of a second dye to decrease continuously with the concn. of the impurity. W. R. A.

Spectrophotometric researches in electrophotoluminescence. G. Destriau and P. Loudette (J. Phys. Radium, 1940, [viii], **1**, 51—55).—A detailed account of work already noted (cf. A., 1939, I, 301, 404). W. R. A.

Cathode materials. I. Zone model of the oxide cathodes. Y. Uehara and M. Takahashi (Bull. Chem. Soc. Japan, 1940, **15**, 15—21).—Theoretical. A semi-conductor model, giving the energy levels of the oxide crystals, is used in the development of a theory of thermionic emission, which satisfactorily explains the experimental facts. The theory also accounts for the fluorescence in alkaline-earth oxides. D. F. R.

Selenium photo-elements. A. Becker (Z. Physik, 1939, **114**, 342—353; cf. A., 1938, I, 4).—A

continuation of earlier work with special reference to the effect of low temp. on the conductivity and spectral sensitivity of the cell. L. G. G.

Charging and lowering of charge of electron-irradiated luminous substances and semi-conductors. E. KRAUTZ (Z. Physik, 1939, **114**, 459—469). L. G. G.

Dielectric constant of water vapour at a frequency of 42 megacycles. A. C. TREGIDGA (Physical Rev., 1940, [ii], **57**, 294—297).—A special heterodyne beat apparatus was employed, and air, being composed of non-polar mols. and hence being expected to have the same ϵ at high and low frequencies, was used as the calibration gas. The Clausius–Mosotti relation was verified for H_2O vapour at const. temp., and ϵ at 760 mm. and at 71·9°, 99·8°, and 147° was 1·0071, 1·0060, and 1·00475, respectively. N. M. B.

Effect of cyclisation on the electric moment of organic molecules. H. DE V. ROBLES (Rec. trav. chim., 1940, **59**, 184—190).—Theoretical. Most probable structures and valency angles for a no. of heterocyclic mols. having O, S, or Se atoms in the ring are deduced by assuming that the sum of the squares of the deviations from the normal valency angles is a min., and from these structures and observed dipole moments the bond moments are calc. They are always > those for the corresponding open-chain mols., irrespective of whether the ring is highly strained or strain-free. F. J. G.

Dielectric constants of some pairs of diastereomerides. S. WINSTEIN and R. E. WOOD (J. Amer. Chem. Soc., 1940, **62**, 548—551).—The dielectric consts. ϵ of seven pairs of diastereomerides ($\beta\gamma$-diacetoxy-butanes and -pentanes, $\gamma\delta$-diacetoxyheptanes, $\beta\gamma$-dibromo-butanes and -pentanes, $\gamma\delta$-dibromohexanes, γ-bromo-β-acetoxybutanes) have been measured at 25°, and d_4^{25} and n_D^{25} are also recorded. Using Onsager's equation the dipole moments μ have been calc. from ϵ. The ϵ and μ of *meso*- and *erythro*-compounds are compared with those for the corresponding *dl*- and *threo*-compounds. W. R. A.

Dielectric constant of an anisotropic liquid in motion. V. MARININ and V. ZVETKOV (Acta Physicochim. U.R.S.S., 1939, **11**, 837—848; cf. A., 1938, I, 604, 610).—The ϵ of *p*-azoxyanisole is diminished by the application of a magnetic field parallel with the electric field of the condenser, the most rapid change occurring in the range 400—1000 gauss. The effect decreases with rising temp. When the liquid is in laminar flow between the condenser plates the effect of a magnetic field is diminished in proportion to the velocity of flow. The results indicate that in the streaming liquid the mols. are oriented with their long axes parallel to the direction of flow, to an extent $\not<$ 97—98% of the orientation attainable by a magnetic or an electric field. F. L. U.

Polyacrylic acid glasses. E. JENCKEL and E. BRÄUCKER (Z. physikal. Chem., 1940, **185**, 465—468).—Both sol. and insol. polyacrylic acids show an abrupt change of the vol. coeff. at 80—95°, resembling that found for glasses. F. J. G.

Influence of solvents and other factors on the rotation of optically active compounds. XXXVIII. Asymmetric solvent action (continued). T. S. PATTERSON and C. BUCHANAN (J.C.S., 1940, 290—293).—A repetition of previous work (A., 1937, I, 513), in which a difference was found in the mol. solution-vol. (M.S.V.) of Bu^{β} *d*- (I) and *l*- (II) -tartrates in both *l*-menthyl acetate (III) and $PhNO_2$, shows that $PhNO_2$ is an unsuitable solvent since it absorbs moisture from the atm. continuously. The data for $PhNO_2$ are therefore uncertain. Data are also recorded for the M.S.V. of (I) and (II) in $CH_2Ph{\cdot}OBz$ (IV) and for Et *d*- (V) and *l*- (VI) -diacetyltartrates in (IV) and (III). The M.S.V. of (I) is slightly > that of (II) in (III), whilst that of (V) is < that of (VI) in this solvent. In (IV), however, the M.S.V. vals. for the pairs (I) and (II), (V) and (VI) are identical. From these data it is concluded that the solvent action is asymmetric, and this is supported by the observations that the vol. difference for (I) and (II) is in the opposite sense from that for (V) and (VI). W. R. A.

Solvent effects with optically active saturated hydrocarbons. A. W. H. PRYDE and H. G. RULE (J.C.S., 1940, 345—347).—The theoretical relations suggested between the optical activity of a compound and the n of its solution do not hold for the optically-active saturated hydrocarbons *l*-dimenthyl (I), *l*-dibornyl (II), and *d*- (III) and *l*- (IV) -*iso*camphane in various non-polar solvents. M of (III) and (IV) in non-polar solvents rise irregularly with n of the solutions, but the rate of increase is > that expected theoretically; M for (II) shows only a slight tendency to increase with n, and M for (I) tends to decrease as n rises. M for *d*-pinane, however, varies with n according to $M = k(n^2 + 2)^2$. The disparity between theory and experiment increases on passing up the series pinane, (III) and (IV), (II), (I), and this is also the order in which the m.p. increases. W. R. A.

Optical anisotropy of cellulose sheet. R. C. GRAY (Nature, 1940, **145**, 266; cf. A., 1940, I, 148).—The birefringence of Cellophane decreases slightly with an increase in λ of the light used. For sheet ~0·001 in. thick vals. vary from 0·0056 to 0·0132 about a mean of 0·0089; thicker sheets give lower vals. Near the selvedges birefringence is 30% > in the middle. L. S. T.

Inertia of the Kerr effect. W. HANLE and O. MAERCKS (Z. Physik., 1939, **114**, 407—417).—A method is described for measuring the inertia of the Kerr effect with a.c. potentials and pulsating d.c. potentials. The resultant calc. relaxation times for some polar and non-polar liquids are given. L. G. G.

Inertia of the Faraday effect. W. HANLE (Z. Physik., 1939, **114**, 418—426).—A no. of liquids have been examined by a new method for inertia of the Faraday effect. In no case was an effect >0·5 × 10^{-9} sec. observed. L. G. G.

Maximum valency of elements of group VIII. B. ORMONT (Acta Physicochim. U.R.S.S., 1939, **11**, 911—916).—A review of recent work supports the author's contention that the reported existence of

compounds of Fe^{VIII} and Ni^{VIII} is based on erroneous experiments. There is no theoretical foundation for including the 9 transitional elements in a single group. F. L. U.

Directed valency. G. E. Kimball (J. Chem. Physics, 1940, **8**, 188—198).—Theoretical. Group theory is employed to test the possibility of formation of directed covalent bonds in any spatial arrangement, and the possibility of formation of double and triple bonds. L. J. J.

Modern development of the concept of co-ordination. I. Introduction. G. B. Bonino (Gazzetta, 1939, **69**, 763—779).—A survey of the methods of localised bonds (Pauling and Slater) and of mol. orbitals (Mulliken). Using group theory the constitution of CH_4 and of CO_3'' has been studied. O. J. W.

Electronic structure of organic compounds. V. V. Razumovski (J. Gen. Chem. Russ., 1939, **9**, 2019—2040).—Theoretical. All org. compounds are supposed to exist in two electromeric forms. The stability of a given at. grouping rises with increasing mobility of its electronic structure. R. T.

Activation energy for ionic liquids. A. A. Leonteeva (Acta Physicochim. U.R.S.S., 1939, **11**, 861—864).—Van der Waals energies (w) for ionic liquids of the NaCl type have been calc. from data for the corresponding crystal lattices. For such liquids the sum $w + l$ (l = heat of fusion) is approx. the same as the observed val. of the activation energy B in the viscosity–temp. relation $\eta = Ae^{B/RT}$. Exceptions are LiI, AgCl, and AgBr, and in their case it is suggested that only one London effect (dispersion) should be considered in calculating w. F. L. U.

Structure of phosphine and related hydrides. D. P. Stevenson (J. Chem. Physics, 1940, **8**, 285—287).—When Badger's rule (A., 1934, 477) is applied to the νν of some hydrides (CH_4, NH_3, H_2O, SiH_4, PH_3, H_2S, AsH_3, H_2Se), vals. for the interat. distances are obtained in agreement with those deduced from the moments of inertia of these hydrides and also with those predicted from the covalent radius suggested for H_2, 0·315 A. Using the val. 1·415 A. for the P—H distance in PH_3 and a spectroscopic val. for one of the moments of inertia of the mol., the bond angle is 93°. Vals. are suggested for the bond angles and bond distances of SiH_4, PH_3, GeH_4, AsH_3, SeH_2, SnH_4, SbH_3, TeH_2. W. R. A.

Interrelation of molecular constants for di-atomic molecules. II. R. A. Newing (Phil. Mag., 1940, [vii], **29**, 298—301; cf. A., 1935, 685).—From Slater's application of the virial theorem to mol. problems, it is deduced that the known empirical laws relating nuclear distance and vibration frequency would arise from the existence of a common repulsive field for all similar mols. in the neighbourhood of the equilibrium configuration. L. J. J.

Determination of internuclear distances and dissociation energies from force constants. G. B. B. M. Sutherland (J. Chem. Physics, 1940, 8, 161—164).—Theoretical. Results obtained from using a potential energy for di-atoms of the form $V = -\alpha/r^m + \beta/r^n$ and deriving D_e (dissociation energy) $= k_e - r_e^2/mn$, where r_e is equilibrium internuclear distance and k_e is force const. L. J. J.

Phase changes in crystals arising from hindered molecular rotation. J. G. Kirkwood (J. Chem. Physics, 1940, **8**, 205—212).—Theoretical. On the basis of classical statistical mechanics it is shown that local hindrance of relative rotation of neighbouring mols. in a cryst. lattice can produce non-uniform orientation below a crit. temp. A semi-quant. description of λ-transitions in H halides is obtained. L. J. J.

Intensities of electronic transitions in molecular spectra. IX. Calculations on the long-wave-length halogen spectra. R. S. Mulliken (J. Chem. Physics, 1940, **8**, 234—243; cf. A., 1939, I, 551).—Mathematical. W. R. A.

Relation between the energy of a hydrogen bond and the frequencies of the O–H bands. R. M. Badger (J. Chem. Physics, 1940, **8**, 288—289).—The shifts in the ν of the third harmonic of the OH band are related to the energy of the hydrogen bond but not by the linear relationship previously suggested (A., 1938, I, 60). W. R. A.

Partition functions and energy levels of molecules with internal torsional motions. B. L. Crawford, jun. (J. Chem. Physics, 1940, **8**, 273—281).—Mathematical. A method is developed for calculating rotation of pseudo-rigid mols. consisting of a rigid framework to which symmetrical hindered rotators are attached. The method is applied to propylene. W. R. A.

Potential function for plane displacements in the benzene molecule. Calculation of normal plane vibrational frequencies for the molecules s-$C_6H_3D_3$, p-$C_6H_4D_2$, and p-$C_6H_2D_4$. II. E. Bernard, C. Manneback, and A. Verleysen (Ann. Soc. Sci. Bruxelles, 1940, **60**, 45—59).—Fundamental frequencies are calc. for s-$C_6H_3D_3$. L. J. J.

Quasi-crystalline structure of liquids. J. Malsch (Z. Elektrochem., 1939, **45**, 813—815; cf. A., 1939, I, 183).—A correction. Priority is claimed for certain structural concepts. A. J. E. W.

Surface tension and Lindemann frequency. L. Sibaiya and M. R. Rao (Indian J. Physics, 1939, **13**, 293—298).—The relation $\gamma = k^2 m\nu^2$ (cf. A., 1939, I, 406) (ν = Lindemann frequency, m = mass of the atom or mol., and k = const.), applied to available data for 45 elements and compounds, gives a mean val. $k = 2·34$. Experimental data show that η influences the rotational wings in light scattering, and necessitate that η is independent of relative motion. Assuming that the total momentum transferred per oscillation by the mols. across unit area gives η, and inserting $k = 2·34$, it is shown that Andrade's expression for η follows quantitatively. The variation of γ with temp. is explained on the basis of Macleod's relations, and several empirical relations have been derived. W. R. A.

Variable structures and continuous scattering of X-rays from layer silicate lattices. S. B. Hendricks (Physical Rev., 1940, [ii], **57**, 448—454; cf. A., 1939, I, 496).—Crystals of some micas and

related compounds having layer lattices show marked continuous scattering of *X*-rays together with normal interference max. Continuous scattering is explained as arising from destruction of the lattice periodicity normal to the perfect cleavage. This is a result of translation of some layers along the *b* axis and parallel to the cleavage by $nb_0/3$ (b_0 = the unique lattice periodicity; n = an integer). Four general types of degree of randomness are recognised: no irregularity; most elements of the crystal mosaic having a few irregular layers; some elements having a regular sequence of layers and others having many irregular layers; all elements having many irregular layers which leads to a small pseudo unit of structure. N. M. B.

X-Ray absorption measurements of solid chemical compounds on filter-paper. W. Meyer-Cords (Ann. Physik, 1939, [v], **36**, 651—679; cf. Riedmiller, A., 1934, 1059).—Experimental conditions for the measurement of the *X*-ray absorption of elements using filter-papers soaked in aq. solutions of their compounds have been investigated. The mass absorption coeffs. of Mo and Sn on either side of the *K*-edge have been measured on metallic foils and on filter-papers soaked in $3(NH_4)_2O,7MoO_3$ and $Sn(SO_4)_2$ solutions, respectively. A precision vac. balance with sensitivity 1 μg. per scale division for loads $\sim$2 g. is described. O. D. S.

Crystallographic studies of meteoric iron.—See A., 1940, I, 178.

Theory of the origin and growth of metallic crystals from salt solutions. P. D. Dankov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 886—889).—Theoretical. Mechanisms are suggested for the formation and growth of metallic crystals formed during reduction of salt solutions. W. R. A.

Effect of dyes on the crystal habit and optics of sodium and lithium fluorides, sodium and potassium chlorides, and potassium bromide and iodide. C. Frondel (Amer. Min., 1940, **25**, 91—110; cf. A., 1940, I, 150).—The effects of 112 dyes on the crystallisation of these salts are tabulated and discussed. The presence of a dye in the crystallising solution is often accompanied by the development of pigmentation (not mechanical inclusion of dye) and anomalous pleochroism in the crystals, by supersaturation and rate-of-growth phenomena, and by the development of skeletal growths. Most dyes are adsorbed, if at all, by {100}; a few are adsorbed on {111}, and cause variation from the cubic to the octahedral habit. No connexion between the occurrence of pleochroism and habit variation was observed, nor could either of these effects be identified with special characteristics of the dyes concerned. With alkali chlorides the skeletonising effect is absent. Strong adsorption of the dye is accompanied by a tendency towards supersaturation in the crystallising solution. The dye adsorption theories of Buckley (A., 1934, 1160) and France and Davis (A., 1936, 283) are discussed; they do not account adequately for the effects observed. L. S. T.

Crystal structure of sodium sulphate III. L. K. Frevel (J. Chem. Physics, 1940, **8**, 290).—Na_2SO_4 III belongs to the orthorhombic space-group *Pbnn*; the unit cell containing 4 mols. has *a* 5·59, *b* 8·93, *c* 6·98 A. W. R. A.

X-Ray photographs of natural cellulose. T. Kubo (Naturwiss., 1939, **27**, 857—858).—*X*-Ray diagrams for natural cellulose obtained by various observers are discussed. The experiments of Sauter (A., 1937, I, 226) have been repeated with Cr $K\alpha$, W $L\alpha$, and W $L\beta$ rays. With Cr $K\alpha$ rays and a Cu anticathode the four innermost reflexions observed by Sauter are not present, and it is concluded that these were due to the rays not being monochromatic. A. J. M.

Bromine—bromine distance in the dibromides of *cis*- and *trans*-stilbene. J. D. McCullough (J. Amer. Chem. Soc., 1940, **62**, 480—482).—The Br—Br separations in the mols. of cryst. stilbene dibromides, measured by the radial distribution treatment of *X*-ray powder photographs, are 4·50 (*meso*) and 3·85 A. (*dl*). In the *meso*-form all like groups are *trans* to one another, whilst in the *dl*-form the Br atoms approach as close as the van der Waals' radius for Br will allow. The results agree with the dipole moment data of Weissberger (A., 1938, II, 121.) W. R. A.

Intramolecular folding of polypeptide chains in relation to protein structure.—See A., 1940, II, 199.

Molecular structure of the collagen fibres. W. T. Astbury and F. O. Bell (Nature, 1940, **145**, 421—422).—A model, based on chemical and *X*-ray evidence, is reproduced photographically. The average length per NH_2-acid residue in the direction of the fibre axis is $\sim$2·86 A., and the intramol. pattern requires a row of 288 residues, grouped in approx. sets of 12, 24, and 36. All the extended forms of the fibrous proteins fall into either of two classes; they are built from polypeptide chains in either the *cis*- or the *trans*-configuration. L. S. T.

Electron-diffraction in thin silver and gold films prepared by cathodic sputtering on crystalline supports. A. Bojinescu (Bull. Soc. roum. Phys., 1936, **37**, No. 67, 3—18; Chem. Zentr., 1937, i, 4067).—Films sputtered on to NaCl, $NaNO_3$, KI, $CuSO_4$, alum, and tartaric acid crystals and dissolved off in H_2O showed no influence of the support on crystal orientation in the film, except with NaCl. The degree of orientation increases with the thickness of the film. A. J. E. W.

Electron diffraction of oxide films on light metals: Mg, Al, and Be. S. Yamaguchi (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 463—470). —Polished specimens of Mg were heated at various temp. (at room temp. for 1 day, 100° for 10 hr., 200° 4 hr., 300° 2 hr., 400° 1 hr.) in air and cooled. The diffraction patterns of the room temp. and 100° specimens (hexagonal, closest-packing) are those of pure Mg; that of the 400° specimen (cubic, NaCl type) is due to MgO; those of the 200° and 300° specimens are due to mixtures of Mg and MgO. From a comparison of the intensity of the diffraction rings for the different specimens it is concluded that the MgO film on the 400° specimen is pervious to

electrons accelerated at 50 kv., but afford a strong protection against further atm. oxidation. A film of MgO is formed even at room temp. but it is only ~10 A. thick. A specimen of Al, exposed to air for 10 days, shows diffraction rings of γ-Al_2O_3 and the Al pattern (cubic system, face-centred). The transition point for the γ-Al_2O_3 (cubic system) and α-Al_2O_3 (hexagonal system) lies between 400° and 500°. It is probable that Be forms a BeO layer on exposure to the atm. at room temp., but this has not been proved. W. R. A.

Molecular structure of fluorobenzene and *o*-difluorobenzene by electron diffraction. H. OOSAKA (Bull. Chem. Soc. Japan, 1940, **15**, 31—36).—The C—F distances in PhF and in *o*-$C_6H_4F_2$ are 1·34±0·04 and 1·35±0·03 A., respectively. These distances are < those expected from the covalent radii of Pauling and Huggins (A., 1934, 350). The results are discussed in relation to the dipole moments and the degree of double bond character of the mols. D. F. R.

Approach to saturation in the magnetisation of nickel between 135° and —253°. Variation of the crystal energy with temperature. H. POLLEY (Ann. Physik, 1939, [v], **36**, 625—650).—The variation with field, H, of the differential susceptibility dI/dH of Ni at temp. 135° to —253° has been investigated for vals. of H up to 3000 oersted. Results are expressed by $dI/dH = A/H^3 + B/H^2 + \chi_c$ where A, B, and χ_c vary with temp. The term AH^{-3} is ascribed to rotation processes and vals. of the crystal energy K are calc., which agree with vals. for single cryst. Ni. K increases with decreasing temp. and appears to reach a saturation val. near 0° K. The abs. val. of χ_c is $\gg$ that given by the Langevin–Weiss theory but its temp.-dependence agrees with the theory. O. D. S.

Structure and ferromagnetism of cold-worked copper containing iron. C. S. SMITH (Physical Rev., 1940, [ii], **57**, 337; cf. Bitter, A., 1940, I, 67).—Cu containing small amounts of Fe in solid solution is not ferromagnetic even if cold-worked. On heat-treatment Fe ppts. rapidly in a relatively stable non-ferromagnetic form and is immediately transformed by cold-working into the magnetic condition. *X*-Ray investigations show that there is little body-centred cubic Fe (probably none) in Cu–Fe alloys containing the non-magnetic ppt., but that it becomes detectable after cold-working, coincident with the appearance of ferromagnetic properties. N. M. B.

Hysteresis in ferromagnetics. E. KONDORSKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 738—742).—Theoretical. It is shown that if the area of the hysteresis loop and the coercive force of a ferromagnetic substance with almost rectangular loop are independent of the shape of the specimen, the hysteresis is due to non-homogeneity of the material. J. W. S.

Theory of ferromagnetism. H. A. KRAMERS (Comm. Kamerlingh Onnes Lab., Suppl., 1936, No. 83, 22 pp.; Chem. Zentr., 1937, i, 3606).—A theory based on the Heisenberg model of ferromagnetism leads to the results of Heisenberg for high temp. and of Bloch for very low temp., although fundamentally different methods are used. A. J. E. W.

Significance of the anomalies of the optical constants of thin metallic layers. E. DAVID (Z. Physik, 1939, **114**, 389—406).—Theoretical. The λ-dependence of the optical consts. of thin sputtered metal films is ascribed to dipole vibration of the crystallites of the layer at frequencies spread over the visible and infra-red range. L. G. G.

Strength of quartz glass. A. SMEKAL (Z. Physik, 1939, **114**, 448—454; cf. A., 1939, I, 459).—General observations on the effect of experimental conditions on the vals. of the tensile strength of quartz glass. L. G. G.

Alpha-gamma transformation of iron at high pressures and the problem of the earth's magnetism. F. BIRCH (Amer. J. Sci., 1940, **238**, 192—211).—The effect of pressure on the temp. (T_{A_3}) of the α–γ transition of Fe of high purity has been studied by a dilatometric method up to 4540 kg. per sq. cm. Above 1000 kg. per sq. cm., $dT_{A_3}/dp =$ —8·5° per 1000 kg. per sq. cm. The latent heat of the transition is ~4 g.-cal. per g. The existence of α-Fe in the earth is restricted to a shell of $\ngtr$50 km. depth. The effect of the results and the possible effect of admixtures (*e.g.*, Ni) on the problem of the earth's magnetism is discussed. L. J. J.

Diamagnetism of small regions and the super-conducting state. J. C. SLATER (Physical Rev., 1938, [ii], **53**, 208).—An extension of previous discussions (A., 1937, I, 504). L. S. T.

Paramagnetic relaxation times for titanium and chrome alum. J. H. VAN VLECK (Physical Rev., 1940, [ii], **57**, 426—447).—Mathematical. Calculations are based on a model obtained by combining the Casimir–Du Pré thermodynamic theory with a treatment of the normal modes of a cluster of the form $X,6H_2O$, where X contains an incomplete shell. N. M. B.

Magnetic susceptibility of silver subfluoride. S. FREED, N. SUGARMAN, and R. P. METCALF (J. Chem. Physics, 1940, **8**, 225—226).—The molal magnetic susceptibility of Ag_2F is $-64·3 \pm 1·2 \times 10^{-6}$ e.m.u. at room temp. and 77° K. It is concluded that free electrons contribute a high diamagnetism, enhanced by the anisotropic character of the crystals. L. J. J.

Theory of paramagnetic relaxation. L. S. ORNSTEIN (Physica, 1940, 7, 205—207).—The relation between the fundamental equations of Gorter and Kronig and of Casimir and Du Pré is discussed. L. J. J.

Velocity of sound in liquid argon. H. W. LIEPMANN (Helv. Phys. Acta, 1939, **12**, 421—442).—The velocity of sound and its variation with temp. have been measured in liquid A and liquid N_2 by means of the diffraction of light by 7508·8-kHz. ultrasonic waves. In A the velocity increases approx. linearly from 842 m. per sec. at —186·5° to 867 m. per sec. at —189·5° (±0·5%); in N_2 the velocity increases linearly from 868 m. per sec. at —197·0° to 929 m. per sec. at —203·0° (±1%). L. J. J.

Sound-wave pressure in liquids. G. HERTZ and H. MENDE (Z. Physik, 1939, **114**, 354—367).—The behaviour of supersonic waves in passing through the boundary of immiscible liquids is examined practically and theoretically. L. G. G.

Dispersion of supersonic waves in cylindrical rods of polycrystalline silver, nickel, and magnesium. S. K. SHEAR and A. B. FOCKE (Physical Rev., 1940, [ii], **57**, 532—537).—The velocities of elastic waves in polycryst. rods of Ag, Ni, and Mg were measured at supersonic frequencies 120—750 kc. Comparison of the experimental dispersion curves with those calc. on the Giebe–Blechschmidt dispersion theory shows that the theory accounts satisfactorily only for low-frequency dispersion. N. M. B.

Ultrasonic velocities and adiabatic compressibilities of some organic liquids. J. BHIMASENACHAR and K. VENKATESWARLU (Proc. Indian Acad. Sci., 1940, **11**, **A**, 28—31).—Ultrasonic velocities (v) in 14 pure liquids and the chief constituents of 6 essential oils have been measured at $\sim$27° at 4·3, 7·2, 10·0, and 13·0 " M.C." For acetates v in the aromatic series is $>$ in the aliphatic series. For MeI, EtI, and $Bu^{\alpha}I$ v increases with increasing mol. wt., whilst ρ decreases. Calc. adiabatic compressibilities are recorded. W. R. A.

Variations in the b.p. and f.p. of some substances in the regions of East Africa higher than 2000 m. above sea-level. G. SOLLAZZO (Boll. Chim. farm., 1940, **79**, 1—6).—The b.p. and f.p. of H_2O, EtOH, acetphenetidide, pyramidone, terpene, picric acid, and Ph salicylate at an altitude of 2560 m. above sea-level are recorded. O. J. W.

Physical properties of some purified aliphatic hydrocarbons. D. B. BROOKS, F. L. HOWARD, and H. C. CRAFTON, jun. (J. Res. Nat. Bur. Stand., 1940, **24**, 33—45).—F.p., b.p., n_D, and d data are recorded for $CH_2{:}CHBu^{\gamma}$, $CH_2{:}CMePr^{\beta}$, $CMe_2{:}CMe_2$, CMe_3Et, Pr^{β}_2, $CH_2{:}CMeBu^{\gamma}$, CMe_3Pr, $CHEt_3$, $CHMePr^{\beta}_2$ (I), n-C_7H_{16} (II), and $CH_2Pr^{\beta}Bu^{\gamma}$ (III). The isolation of (I) from a mixture of isomeric octanes, the purification of (II) and (III), and the synthesis of the other hydrocarbons are described. J. W. S.

Electronic specific heat of graphite. K. S. KRISHNAN (Nature, 1940, **145**, 388).—The low degeneracy temp. of the electron gas and the no. of free electrons, one per C atom, should make the electronic sp. heat of graphite at room and at low temp. $\gg$ that of most metals. The available experimental data support this view. Even at 40° K. the electronic contribution to the sp. heat is $\gg$ that from the lattice. L. S. T.

Specific heat of superconducting mercury, indium, and thallium. A. D. MISENER (Proc. Roy. Soc., 1940, **A**, **174**, 262—272).—The transition between superconducting and normal states in a magnetic field gives formulæ from which the entropy and sp. heat differences in the two states can be calc. The threshold field curves were determined down to 1° K. and the sp. heats of Hg, In, and Tl deduced. G. D. P.

Molecular specific heat of hydrocarbons of different degrees of saturation. V. I. KUZNETZOV (J. Gen. Chem. Russ., 1939, **9**, 2009—2011).—The mol. sp. heat of saturated is $>$ of unsaturated compounds. R. T.

Specific heat ratios for hydrocarbons. W. C. EDMISTER (Ind. Eng. Chem., 1939, **32**, 373—375).—A chart is developed for determining γ ratios for CH_4, C_2H_4, C_2H_6, $CH_2{:}CHMe$, C_3H_8, $CH_2{:}CMe_2$, $CHMe_3$, $CHMe{:}CHMe$, n-C_4H_{10}, CH_3Bu^{β}, n-C_5H_{12}, C_6H_6, $(CHMe_2)_2$, n-C_6H_{14}, n-C_7H_{16}, $(CH_2Pr^{\beta})_2$, and n-C_8H_{18} at reduced pressures 0—1·2 and reduced temp. 0·7—2·5. J. W. S.

Thermal data. XI. Heat capacities and entropies of guanidine carbonate, glutamic acid hydrochloride, ornithine dihydrochloride, and *d*- and *l*-lactic acids. H. M. HUFFMANN, E. L. ELLIS, and H. BORSOOK (J. Amer. Chem. Soc., 1940, **62**, 297—299).—From heat capacity measurements for the temp. range 84° to 298° K. the following vals. of $S_{298\cdot1}$ are calc.: guanidine carbonate, 70·59; glutamic acid hydrochloride, 59·33; ornithine dihydrochloride, 70·25; *d*- and *l*-lactic acids, 34·30 and 34·00 g.-cal. per degree per mol. 4030 g.-cal. per mol. is given as a preliminary val. of the heat of fusion of *d*-lactic acid. W. R. A.

Heat capacities, heats of transition and fusion, and entropies of ethylene dichloride and dibromide. K. S. PITZER (J. Amer. Chem. Soc., 1940, **62**, 331—335).—C_p for $(CH_2Cl)_2$ and $(CH_2Br)_2$ have been measured from 15° to 308° and 318° K., respectively. From the C_p/T curve $(CH_2Cl)_2$ shows a big anomaly at 174—180° K. and $(CH_2Br)_2$ has a transition point at 249·52$\pm$0·1° K. and heat of transition = 463·8$\pm$2 g.-cal. per mol. The following data, for $(CH_2Cl)_2$ and $(CH_2Br)_2$ respectively, are given: m.p., 237·2$\pm$0·1°, 283·0$\pm$0·2°; heat of fusion, 2112·0$\pm$2, 2615·8$\pm$5 g.-cal. per mol.; $S_{298\cdot1}$, 49·84$\pm$0·15, 53·37$\pm$0·2 g.-cal. per degree per mol. A tentative explanation of the " transitions " in both mols. is advanced. W. R. A.

Specific heats of solid aromatic acids and their ammonium salts and the atomic heat of nitrogen. S. SATOH and T. SOGABE (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 449—457).—Sp. heats from 0° to 99·6° have been determined for solid benzoic, cinnamic, *o*- and *m*-phthalic acids and their NH_4 salts. The difference between the mol. heats of the salt and acid gives the mol. heat of solid NH_3 and by subtracting 2·4 (for solid H) the at. heat of N was obtained. From the $(NH_4)_1$ salt and acid the mean val. for the at. heat of N is 5·3, whilst from the $(NH_4)_2$ and $(NH_4)_1$ salts it is 1·7, and from the $(NH_4)_2$ salt and acid it is 3·3. These data are compared with similar data deduced from mol. heats of aliphatic acids and their NH_4 salts (A., 1939, I, 461) and from nitrides (*ibid.*, 310). W. R. A.

Entropy of long-chain compounds in the gaseous state. M. L. HUGGINS (J. Chem. Physics, 1940, **8**, 181—187).—Theoretical. L. J. J.

Variation of the adiabatic and isothermal elastic moduli and coefficient of thermal expansion with temperature through the λ-point transition in ammonium chloride. A. W. LAWSON (Physical Rev., 1940, [ii], **57**, 417—426).—Measurements for pressed specimens of NH_4Cl near

the λ-point transition at 242·8° K. are reported. There is a large difference between the adiabatic and isothermal compressibilities below the crit. temp., and hence between C_p and C_v. The data, with the known temp. variation of C_p, allow the evaluation of the temp. variation of C_v, and from this it is concluded that the transition is not to be associated, as previously suggested by Pauling (cf. A., 1930, 1356), with almost free rotation of the NH_4 radicals in the crystal lattice, but rather that the tetrahedra execute rotational oscillations both below and above the transition temp., with order, destroyed at the transition temp., in the orientations of the axes about which the oscillations occur. N. M. B.

Density of gaseous chlorine. A. S. Ross and O. Maass (Canad. J. Res., 1940, **18**, B, 55—65).—The density of Cl_2 at 15—75° and at 20 cm. to 2 atm. has been determined, and tables of the abs. density and apparent mol. wt. are given; *e.g.*, at 1 atm. and 15° the calc. and observed mol. wts. are 71·84 and 71·81 respectively. The equation of state of Maass and Mennie (A., 1926, 233) holds. F. J. G.

Thermodynamic properties of substances. III. Vapour volumes as functions of reduced temperature alone. H. A. Fales and C. S. Shapiro (J. Amer. Chem. Soc., 1940, **62**, 393—406).—The reduced vapour vol. of chemically different substances is an exponential function of reduced temp. alone and is identical in form with those for v.p. and for vol. ratio. W. R. A.

Density of molten antimony trichloride. D. I. Shuravlev (J. Phys. Chem. Russ., 1939, **13**, 684—686).—*d* has been determined for the liquid at 74—504° and for the saturated vapour at 324—470°. The crit. pressure is found to be 58·7 atm. R. C.

Pressure–volume–temperature relations for *n*-butane. W. B. Kay (Ind. Eng. Chem., 1940, **32**, 358—360).—The v.p. of n-C_4H_{10} has been measured at 0—300° F. and the *d* of the liquid and vapour at 125—300° F. The crit. consts. and compressibilities of both liquid and vapour phases are in accord with the vals. obtained by previous investigators (cf. A., 1939, I, 134). J. W. S.

Vapour pressures, heats of vaporisation, and m.p. of $^{14}NH_3$ and $^{15}NH_3$. H. G. Thode (J. Amer. Chem. Soc., 1940, **62**, 581—583).—Using a differential oil manometer the v.p. difference between NH_3 and a 70·6% $^{15}NH_3$ in the liquid state has been measured from 198° to 239·5° K. The v.p. of NH_3 is > that of the $^{15}NH_3$ by 0·371% at 195° K. and 0·174% at 239·68° K. (b.p.). The v.p. data are represented by $\log_{10}(P_1/P_2) = 0{\cdot}9593/T - 0{\cdot}00325$ (P_1 = v.p. of NH_3, P_2 = v.p. of the $^{15}NH_3$). The heat of vaporisation of the 70·6% $^{15}NH_3$ exceeds that of NH_3 by 4·39 g.-cal. per mol. The triple point of NH_3 is 0·083° < that of the $^{15}NH_3$. W. R. A.

Determination of vapour pressure of aluminium chloride and molten mixtures with sodium chloride at high temperatures. I. I. Narischkin (J. Phys. Chem. Russ., 1939, **13**, 690—692).—The v.p. of $AlCl_3$ at 154—193° is given by $\log p = -4873/T + 13{\cdot}602$. The v.p. of various molten mixtures of $AlCl_3$ and NaCl have been measured. R. C.

Physical properties of alkyl fluorides and comparison of alkyl fluorides with other alkyl halides and with alkyls of the elements of period II. A. V. Grosse, R. C. Wackher, and C. B. Linn (J. Physical Chem., 1940, **44**, 275—296).—In addition to v.p., ρ, *n*, and the respective temp. coeffs., the m.p. and b.p. (at 760 mm. of Hg) have been determined for the following: MeF −141·8°, −78·5°; EtF −143·2°, −37·1°; $Pr^{\alpha}F$ −159°, −2·5°; $Pr^{\beta}F$ −133·4°, −9·4°; *sec.*-BuF −121·4°, 25·1°; $Bu^{\gamma}F$ −77°, 12·1°; *tert.*-$C_5H_{11}F$ −12·1°, 44·8°. Comparison is made with published data and with similar data for RCl, RBr, and RI and for CR_4, NR_3, and R_2O. For a given R, m.p. and b.p. increase in the orders F<Cl<Br<I and F<O<N<C. A lengthy bibliography is appended. C. R. H.

Isothermal changes in enthalpy for some gases. R. York, jun., and H. C. Weber (Ind. Eng. Chem., 1940, **32**, 388—392).—For hydrocarbons with crit. temp. (T_c) 300—500° K. isothermal changes of enthalpy with pressure have been correlated by the empirical relation $(H_0 - H)_T = \Delta_1 T_c(T_c/370)^n$, where H_0 is the enthalpy at zero pressure, *n* is a function of T_c, and Δ_1 is a function of the reduced temp. (T_r) and reduced pressure (P_r). The vals. of *n* and Δ_1 are recorded in graphs. The relation holds over the ranges T_r = 1·00—1·80 and P_r = 0—8. J. W. S.

Analytical calculations of thermodynamic properties. H. M. Robinson and H. Bliss (Ind. Eng. Chem., 1940, **32**, 396—398).—Equations for calculating entropy, enthalpy, and energy changes during changes in vol. at const. temp. have been derived from the van der Waals, Wohl, and Beattie–Bridgeman equations of state, and are compared with graphically determined vals. for C_3H_8, N_2, and CH_4. The Beattie–Bridgeman equation is accurate to 5—7% for entropy calculations and to 10—15% for enthalpy and energy calculations, but the other equations show greater deviations. J. W. S.

Second virial coefficient of ethane. E. E. Roper (J. Chem. Physics, 1940, **8**, 290).—An equation given by Eucken and Parts (A., 1933, 453) is corr. W. R. A.

Transformations of matter–radiation gas mixtures. R. M. Whitmer (Physical Rev., 1940, [ii], **57**, 516—521).—Mathematical. N. M. B.

Heat conductivity of liquid helium II. W. H. Keesom and B. F. Saris (Physica, 1940, **7**, 241—252).—The thermal conductivity (*k*) of liquid He II has been measured in the range 1·2—2·2° K. in a capillary filled with the liquid, under approx. its saturation pressure. *k* decreases with increasing rate of heat transfer and has a max. val. at ~1·92° K. Below 1·84° K., *k* is independent of the capillary diameter; above this temp. *k* is greater in a narrow than in a wider capillary. The effect of length of capillary is small. L. J. J.

Thermal conductivity of some solidified liquids and gases (benzene, hydrogen bromide, and nitrous oxide). A. Eucken and E. Schröder (Ann. Physik, 1939, [v], **36**, 609—620).—Apparatus for the measurement, by a modified Schleiermacher method, of the thermal conductivity, *k*, of solidified liquids and gases at low temp. is described. *k* of

C_6H_6, HBr, and N_2O has been measured at 90—273° K., 78—142° K., and 90—150° K., respectively. k of $C_6H_6 \propto 1/T$. k of HBr increases suddenly at the lowest transition point (~90° K.). k of N_2O is $\ll$ that of CO_2. It is concluded that torsion vibrations are important for the k of solids with a mol. crystal lattice. O. D. S.

Viscosity of liquid deuterium. A. VAN ITTERBEEK and O. VAN PAEMEL (Physica, 1940, **7**, 208).—Data for η of liquid D_2 are recorded, measured by the oscillating-disc method, from $\eta = 532 \times 10^{-6}$ poise at 18·74° K. to 297×10^{-6} poise at 23·65° K. L. J. J.

Viscosity of neon, hydrogen, deuterium, and helium as a function of temperature between room temperature and liquid hydrogen temperatures. A. VAN ITTERBEEK and O. VAN PAEMEL (Physica, 1940, **7**, 265—272).—Data are recorded for η of Ne, D_2, H_2, and He, obtained by the oscillating-disc method at temp. down to 12·5° K. The vals. for Ne and earlier data (cf. A., 1939, I, 68) for A agree with Weber's reduced curve for other gases (*ibid.*, 411) except at low temp., where Weber's extrapolation does not hold. The reduced curves for H_2 and He are approx. parallel to the general curve. The ratio η_{D_2}/η_{H_2} decreases with the temp. to a const. val. 1·24 between 20° and 12·5° K. L. J. J.

Structure mechanics of viscous-elastic continua. III. Thermodynamics of viscosity. H. UMSTÄTTER (Kolloid-Z., 1940, **90**, 172—177; cf. A., 1938, I, 515).—Mathematical. The temp.-dependence of η is derived from Maxwell's equation and Newton's law of cooling without any assumptions about the structure of the continuum. The slope of the η–temp. curves increases with increase of the crit. temp., and decreases with increase in thermal conductivity. F. L. U.

Calculation of the thermal diffusion constant from viscosity data. R. C. JONES and W. H. FURRY (Physical Rev., 1940, [ii], **57**, 547; cf. A., 1939, I, 395).—A discussion and revision of the assumptions on which results previously reported (cf. Brown, A., 1940, I, 155) were based. N. M. B.

Coefficient of thermal diffusion of neon and its variation with temperature. A. O. NIER (Physical Rev., 1940, [ii], **57**, 338).—Investigations previously reported for CH_4 (cf. A., 1940, I, 65) are extended to Ne. Vals. found for the coeff. in several temp. ranges are compared with those calc. from Enskog's theory for elastic spheres. N. M. B.

Generalised theory of diffusion. I, II. E. J. HELLUND (Physical Rev., 1940, [ii], **57**, 319—328, 328—333; cf. A., 1940, I, 18).—Mathematical. The theory of diffusion in ternary and higher-order gas mixtures is developed as an extension of the theory of Enskog for binary mixtures. Attention is given to the theory of osmotic diffusion in connexion with the Loschmidt experiment. The analysis is conducted so as to be applicable to Einstein–Bose, Fermi–Dirac, and Maxwell–Boltzmann type gases. Pressure diffusion and thermal diffusion are treated. N. M. B.

Phase equilibria in hydrocarbon systems. XXVIII. Joule-Thomson coefficients for gaseous mixtures of methane and *n*-butane. R. A. BUDENHOLZER, B. H. SAGE, and W. N. LACEY (Ind. Eng. Chem., 1940, **32**, 384—387).—Joule-Thomson coeffs. for various CH_4–n-C_4H_{10} mixtures have been determined at 70—310° F. and 50—1500 lb. per sq. in. The isobaric heat capacities at various temp. and pressures and the isothermal enthalpy pressure coeffs. at 250° F. have been deduced. J. W. S.

Viscosity of ammonia–water mixtures at 20°. V. A. PLESKOV and I. IGAMBERDIEV (J. Phys. Chem. Russ., 1939, **13**, 701—702).—η has been determined for the complete range of mixtures, and is a max. for ~72% of H_2O. R. C.

Viscosity of solutions of electrolytes as a function of the concentration. VI. Potassium bromide and lanthanum chloride. G. JONES and R. E. STAUFFER. **VII. Silver nitrate, potassium sulphate, and potassium chromate.** G. JONES and J. H. COLVIN (J. Amer. Chem. Soc., 1940, **62**, 335—337, 338—340; cf. A., 1937, I, 237).—VI. Determination of abs. ρ and relative η of solutions of KBr at 0° and of $LaCl_3$ at 25° and 0° confirms existing equations for ρ, η, and the influence of interionic attraction on η.

VII. Similar determinations for $AgNO_3$, K_2SO_4, and K_2CrO_4 also confirm the same equations but disagree with the law proposed by Simon that isomorphous substances have the same influence on η. W. R. A.

Viscosity of electrolytic mixtures in dilute solution. A. S. CHACRAVARTI and B. PRASAD (Trans. Faraday Soc., 1940, **36**, 557—560; cf. A., 1940, I, 66).—ρ and η data at 35° are recorded for aq. NaCl and for its mixtures with $BaCl_2$ and with $MgCl_2$ at total concns. 0·01—0·07M. The Jones and Dole equation is applicable in all cases, and the coeff. A of the $\sqrt{c}$ term is a linear function of the composition. F. L. U.

Effect of hydrochloric acid on viscosity of barium and magnesium chloride solutions. A. S. CHACRAVARTI and B. PRASAD (Trans. Faraday Soc., 1940, **36**, 561—564; cf. preceding abstract).—The Jones and Dole equation, if used in the form $\eta/\eta_0 = \eta_{HCl}/\eta_0 + A\sqrt{c} + Bc$, satisfactorily represents the η of $BaCl_2$ and of $MgCl_2$ of concn. up to 0·05M. in aq. HCl up to 0·05M. The val. of A decreases linearly with increase in [HCl] up to a certain concn. at which it becomes, and beyond which it remains, zero. F. L. U.

Temperature-dependence of the apparent molecular volume of dissolved electrolytes. II. B. PESCE (Atti X Congr. Internaz. Chim., 1938, II, 420—426; cf. A., 1936, 678).—The mol. vol. of $Ca(NO_3)_2$ in H_2O at 0—85° and in MeOH at 0—45° has been measured. In H_2O the mol. vol. increases and in MeOH decreases with rise in temp. O. J. W.

Surface activity. III, IV. Relations between surface tension, internal pressure, vapour pressure, and osmotic pressure. A. GIACALONE (Gazzetta, 1940, **70**, 37—47, 47—57; cf. A., 1939, I, 368).—III. F.p. measurements of aq. solutions of

PrOH and BuOH are recorded. The results are compared with similar data for MeOH and EtOH.

IV. F.p. measurements for solutions of HCO_2H, AcOH, $EtCO_2H$, and $PrCO_2H$ are recorded. Deviations from the laws of Raoult and van 't Hoff are discussed. The deviations depend not only on the concn. of the solute, but also on the length of the C chain. O. J. W.

Determination of molecular and ionic weights of dissolved substances by the methods of dialysis and free diffusion. G. JANDER and H. SPANDAU (Z. physikal. Chem., 1939, **185**, 325—367).—In view of the discrepancies between the results of Brintzinger, obtained by the method of dialysis (cf., *e.g.*, A., 1931, 448), and those of Jander, obtained by the method of free diffusion and by other methods (cf., *e.g.*, A., 1931, 183), for the constitution of acidified tungstate and molybdate solutions, the former method has been critically investigated. It is confirmed that on dialysis the concn. falls according to $C_t = C_0 e^{-\lambda t}$, but λ depends on the rate of stirring. Filtration due to differences of hydrostatic pressure in the two vessels, and vol. changes due to osmosis, are sources of error but can easily be eliminated. λ is independent of the concn. of the ion under investigation, but depends markedly on the concn. of the foreign electrolyte and on η. With $NaNO_3$ as foreign electrolyte $\lambda\eta$ is const. over a concn. range of 0·5—8M. and is independent of [H$^{\cdot}$] over the p_H range 0—12, but in other electrolytes neither λ nor $\lambda\eta$ is const. The fundamental assumption that mol. wt. $\propto \lambda^{-2}$ implies λ/D (D = diffusion coeff.) = const., but for Cellophane and Cuprophane membranes λ/D decreases with increasing mol. wt. This suggests that the wandering of the ions through the pores of the membrane is hindered to a greater extent for the large ions, the radii of which are approx. those of the smaller pores, and so these membranes are unsuitable. On the other hand "Cellafilters" having a mean pore-radius ~500 A. give const. vals. for λ/D, and when these are used, with a const. rate of stirring, equal hydrostatic pressures in the two vessels, and 0·5—8N-$NaNO_3$ as foreign electrolyte, the dialysis method gives trustworthy results. F. J. G.

Apparent equivalent refraction of calcium nitrate in methanol solution. B. PESCE (Atti X Congr. Internaz. Chim., 1938, II, 416—419).—Measurements of d and n for solutions of $Ca(NO_3)_2$ in MeOH at 25° are recorded. The equiv. refractivity increases with the concn. O. J. W.

Optical and magneto-optical study of mixtures. J. RABINOVITCH (Ann. Physique, 1940, [xi], **13**, 176—238).—Dispersion curves obtained by polarimetric measurements show that, in the case of solutions of β-pinene in C_6H_6, departures from Biot's law of additivity are due to mol. association; this is supported by magnetic rotation and birefringence measurements which show the absence of polymerisation or dimorphism of β-pinene. Simultaneous studies of the two last-named measurements elucidate anomalies in inactive mixtures: the two magneto-optical effects show marked divergences from the additivity law for solutions of 2-$C_{10}H_7$Me in CCl_4, and the direction and magnitude of the anomalies can be explained on the assumption of a mol. transition, the β-derivative being partly transformed into the α-form. N. M. B.

Absorption of radio-waves and study of binary systems. L. CAVALLARO (Atti X Congr. Internaz. Chim., 1938, II, 199—206; cf. A., 1937, I, 601).—The absorption of radiation of λ 5 and 26 m. by pyrrole–piperidine and by EtOH–H_2O mixtures has been measured at low temp. The results indicate the formation of a salt-like compound in the first system. In the second system there appears to be a transition between two states of association at 92 mol.-% EtOH, which is the mixture of min. b.p. O. J. W.

Viscosity in the systems ketones–organic acids. IV. V. V. UDOVENKO and R. P. AIRAPETOVA. **V.** V. V. UDOVENKO and S. I. VITJAEVA (J. Gen. Chem. Russ., 1939, **9**, 1796—1800, 1731—1733; cf. A., 1940, I, 65).—IV. The composition–η curves of the systems HCO_2H–, AcOH–, or $PrCO_2H$–C_6H_6–COMePr, at 25°, are concave to the composition axis, whilst in absence of C_6H_6 they are convex. This is ascribed to decrease in association of the acids due to dilution of the system. The curves suggest compound formation between COMePr and the org. acids to a degree diminishing in the order given.

V. Analogous results are obtained in the systems HCO_2H–, AcOH–, or $PrCO_2H$–$COMe_2$–C_6H_6, at 25°. R. T.

Dielectric loss of nitrobenzene–benzene and ethyl alcohol–benzene mixtures. G. M. PANTSCHENKOV and O. K. DAVTJAN (J. Phys. Chem. Russ., 1939, **13**, 651—659).—An accurate method of determining the tangent of the angle, δ, of dipole losses of dielectrics is described. For the above mixtures tan δ varies with the concn. in the same way as does the mol. polarisation. From the results the period of relaxation, τ, has been calc. and from it the mol. radius, r. The relation of the val. of r to the form of mol. rotation in an alternating electric field is discussed. A formula permitting the calculation of τ from the macroscopic η and temp. only has been deduced. R. C.

Physical properties of the ternary system butyl alcohol–ethyl acetate–toluene. E. E. LITKENHOUS, J. D. VAN ARSDALE, and I. W. HUTCHISON, jun. (J. Physical Chem., 1940, **44**, 377—388).—ρ, η, surface tension, n, and b.p. of the system Bu^{a}OH–EtOAc–PhMe have been determined, and are recorded in tabular form and on binoidal and triangular diagrams. C. R. H.

Anomalous mixed-crystal formation between alkali and lead halogenates. K. HUBER (Helv. Chim. Acta, 1940, **23**, 302—319).—The possibility of anomalous mixed-crystal formation in the systems $NaClO_3$–$Pb(ClO_3)_2$ and $NaBrO_3$–$Pb(BrO_3)_2$ has been investigated by the use of Th-B as radioactive indicator. $NaClO_3$ crystallises free from Pb$^{\cdot\cdot}$ ions, whereas $NaBrO_3$ forms mixed crystals containing $Pb(BrO_3)_2$, the pptn. ratio α [= (% Th-B pptd.)/(% salt cryst.)] being ~1 at very low [Pb], but decreasing as [Pb] increases. At high [Pb] $Pb(BrO_3)_2$ crystallises independently, without double-salt formation. At concn. approx. saturation with the Pb salts, the

habit of both Na salts is modified; in conjunction with its lower solubility this means that $Pb(BrO_3)_2$ has the greater habit-modifying influence, and suggests a correlation between this and the tendency to form mixed crystals. Further, the circumstance that the modifications are from cubic towards tetrahedral for $NaClO_3$, but from tetrahedral towards cubic for $NaBrO_3$, suggests that only tetrahedral faces incorporate $Pb^{\cdot\cdot}$ ions, and in fact $NaClO_3$ can be cryst. in tetrahedral form from $(CH_2\cdot NH_2)_2$ with a little occluded $Pb(ClO_3)_2$ ($\alpha \sim 0\cdot 2$), but tetrahedral $NaClO_3$ obtained by crystallisation from H_2O in presence of (*e.g.*) Na_2SO_4 is free from Pb, whereas cubic $NaBrO_3$ obtained at $>50°$ contains as much Pb as tetrahedral. The lattice consts. of $NaClO_3$ and $NaBrO_3$ are respectively 6·555 and 6·689 A., and those of their mixed crystals are a linear function of composition. For these mixed crystals α lies on a curve which falls from ~ 1 for $NaBrO_3$ to ~ 0 for $NaClO_3$, without any discontinuity, irrespective of the cubic or tetrahedral habit. F. J. G.

Formation of solid solutions by insertion during dissociation of silver oxide. R. FAIVRE (Compt. rend., 1940, **210**, 398—400; cf. A., 1938, I, 501).—At room temp. dissociation of Ag_2O occurs without change in the cryst. parameter (a 4·688 A.), with progressive formation of finely-divided Ag. At 100—330° the Ag_2O is stabilised, and an increase in a (max. 4·728 A. at $\sim 180°$) indicates insertion of Ag atoms in the lattice. The process is reversible, as a is reduced nearly to its initial val. by slow oxidation; the free Ag oxidises more rapidly than the inserted atoms. The solubility of Ag in Ag_2O is $\not> \sim 4\%$; the supposed oxide Ag_4O is therefore a mixture of the solid solution with Ag. A. J. E. W.

Statistical thermodynamics of super-lattices. R. H. FOWLER and E. A. GUGGENHEIM (Proc. Roy. Soc., 1940, **A, 174**, 189—206).—Bethe's first approximation is shown to be equiv. to the use of a method, called the quasi-chemical method, which assumes that the bond between any pair of nearest neighbours may be treated as if it were a chemical mol. The method had previously been applied to regular assemblies and is now shown to be applicable to an assembly in which long-range order is present. The case considered is that of the body-centred β-brass type of structure. G. D. P.

Diffusion of metals in aluminium. A. BEERWALD (Z. Elektrochem., 1939, **45**, 789—795; cf. A., 1939, I, 69).—The diffusion of metals (M) in Al at 395—600° has been studied at interfaces between pure Al and Al–M alloys; the [M] at different depths in the Al is determined by spectrographic analysis of shavings from the surface. The diffusion apparatus is described. The diffusion consts. are given by $D = ae^{-Q/RT}$, where a and Q, respectively, have the following vals.: M = Cu, 7250, 32,600; Mg, 10,230, 28,600; Ag, 95,400, 32,600; Zn, 10^6, 27,800; Si, 77,800, 30,550. With Cu and Mg the M content of the alloy has no effect on D. D increases as Q falls, but there is no simple relation between D and the m.p., at. radius, no. of valency electrons, or solubility of M. A. J. E. W.

***X*-Ray investigation of the asymmetry of the atoms and of the atomic vibrations in a silver–cadmium alloy.** E. O. WOLLAN (Physical Rev., 1938, [ii], **53**, 203).—In the alloy (Ag 20 at.-%) examined the hexagonal Cd lattice is retained, but the presence of Ag reduces the axial ratio to 1·56, which is < the val., 1·633, for close-packed spheres. The Cd atoms are extended in a direction at right angles to the principal axis of the crystal, and the amplitude of thermal vibration in this direction is > at right angles to it. L. S. T.

Surface structure of β-brass. H. NOWOTNY and A. WINKEL (Z. Physik, 1939, **114**, 455—458).—From powder and rotating-crystal photographs of β-brass using Ga K-radiation the lattice const. is 2·942 A. L. G. G.

Equilibrium diagram of the copper–antimony system. IV. *X*-Ray investigation of copper–antimony alloys. A. ÔSAWA and N. SHIBATA (Sci. Rep. Tôhoku, 1939, **28**, 1—19; cf. A., 1939, I, 464).—The crystal structures of the solid solution phases of the Cu–Sb system have been found by X-ray analysis to be: α, face-centred cubic, lattice const. varies linearly with at. concn. of Sb, sp. gr. 8·92—8·54; β, Cu_5Sb_2, body-centred tetragonal, a, 9·01, c 8·57, A., c/a 0·951, sp. gr. $\sim 8\cdot 9$; γ, Cu_2Sb, simple tetragonal, a 5·62, c 6·07 A., c/a 1·081, sp. gr. 8·446; δ, Cu_9Sb_2, hexagonal, a 10·836, c 8·611 A., c/a 0·795, sp. gr. 8·878; η, $Cu_{11}Sb_2$, orthorhombic, a 9·285, c 8·63, b 8·18 A., sp. gr. 8·909; θ, $Cu_{11}Sb_4$, hexagonal, a 5·495, c 8·686 A., c/a 1·581, sp. gr. 8·617. The crystal structure of Sb is unchanged by the addition of 0·25—1·06% of Cu, indicating that Sb does not dissolve Cu at room temp. O. D. S.

Structural changes due to quenching and tempering of β-phase alloys of the copper–antimony system. A. ÔSAWA and N. SHIBATA (Sci. Rep. Tôhoku, 1939, **28**, 197—215).—The structure of quenched and tempered β-phase alloys (cf. preceding abstract) has been investigated by microscopic, dilatometric, and X-ray methods. By quenching the β phase an intermediate β′ phase is formed which, on tempering, ppts. first δ phase (expansion), then θ phase (contraction), and decomposes to δ + θ at 280—300°. The unit cell of β phase contains 10 Cu and 4 Sb atoms. Alloys containing 55·3—63·5% of Cu and quenched from the β phase have a face-centred tetragonal lattice, a 5·91—5·928 A. c 5·94—6·08 A., c/a 1·007—1·07. Alloys with 63·5—68% of Cu have a cubic lattice, a 5·91—5·928 A., or on tempering a face-centred tetragonal lattice, a 5·94—5·97 A., c 5·8—5·88 A., c/a 0·972—0·980. The lattice of the β′ phase interchanges the a and c axes at about the eutectoid composition, Cu 63·5%. O. D. S.

Lattice spacings of primary solid solutions of silver, cadmium, and indium in magnesium. G. V. RAYNOR (Proc. Roy. Soc., 1940, **A, 174**, 457—471).—As a result of accurate measurement of the lattice spacing it is found that at equiat. compositions In, Cd, and Ag contract the a spacing of Mg by amounts proportional to 1 : 2 : 5, whilst the vol. of the unit cell is contracted in the ratio 1 : 3 : 9. The

results are discussed in terms of the Brillouin zone theory of metals. G. D. P.

Equilibrium and lattice-spacing relations in the system magnesium–cadmium. W. HUME-ROTHERY and G. V. RAYNOR (Proc. Roy. Soc., 1940, A, **174**, 471—486).—The equilibrium diagram has been investigated by thermal, microscopic, and X-ray methods. There is no evidence for the existence of a two-phase region above 250°. The previously reported compound $MgCd_2$ is found to be an oxide–nitride complex formed when the alloys are exposed to the atm. The lattice spacings were measured at 310° by means of a high-temp. X-ray camera and the observed variations are in agreement with theory. G. D. P.

Density measurements [of aluminium–magnesium alloys] at high temperatures. E. PELZEL (Z. Metallk., 1940, **32**, 7—9).—The sp. vol. at the m.p. is for solid Al 0·3933 and for solid Mg 0·6069; the vals. for the liquid metals are 0·4175 and 0·6310, respectively. The contraction on solidification is 5·8% for Al and 3·97% for Mg; min. contraction for the alloys occurs at Al_3Mg_2 (5·36%) and Al_2Mg_3 (4·83%). The sp. vols. of Al–Mg alloys deviate considerably from the mixture rule. A. R. P.

Systems aluminium–calcium, magnesium–calcium, and magnesium–zirconium. H. NOWOTNY, E. WORMNES, and A. MOHRNHEIM (Z. Metallk., 1940, **32**, 39—42).—Al dissolves 2·8% of Ca at 616°, 2·2% at 400° and 1·7% at 300°; there are two compounds both with narrow homogeneity ranges; Al_4Ca, tetragonal a 4·35, c 11·07 A.; Al_2Ca with a C15 type of lattice, a 8·022 A. The Al in Al_2Ca can be replaced by up to 20 at.-% of Mg. Mg dissolves 1·2% of Ca at 500° and 0·8% at 300°, and 0·8% of Zr at 700° and 0·3% at 300°; Zr dissolves 65% of Mg but there appears to be no intermetallic compound although the vol. of the unit cell of the Zr-rich phase shows a min. at Mg_2Zr. A. R. P.

System indium–tin. S. VALENTINER (Z. Metallk., 1940, **32**, 31—35).—Thermal analysis showed a eutectic at 117°, Sn 48 at.-%; X-ray analysis showed the constituents to be In_6Sn_2 and $InSn_{15}$, both tetragonal. At the eutectic temp. In dissolves 15 at.-% of Sn and Sn ~7 at.-% of In. A. R. P.

Permalloy problem. H. SCHLECHTWEG (Physikal. Z., 1940, **41**, 42—43).—A crit. review of the anomalous permeability behaviour of permalloy (~78·5 Ni, 21·5 Fe) with respect to temp. and time of heating and time of cooling. W. R. A.

Copper-rich alloys of the copper–nickel–phosphorus system.—See B., 1940, 285.

Magnetic moments in ferromagnetic alloys. II. Gyromagnetic effect. Relation between supplementary moments and the Curie points. R. FORRER (J. Phys. Radium, 1940, [viii], **1**, 74—80). —The elementary moment of the ferromagnetic alloys Fe–Co–Ni can be resolved into a basic moment due to spin and the supplementary moment of an orbital nature (A., 1939, I, 70, 131, 298). The magnitude $\rho e/m$ of gyromagnetic phenomena can be calc. if the orbital moment is parallel to that of the spin. If, however, the spin and orbit are coupled at an angle, the calc. val. is then the upper limit. Experimental vals. are generally < the calc. val., but tend to it in certain instances, thus confirming the suggested resolution of the elementary moment. The limiting law of Weiss can also be considered as a consequence of these two different moments, if it is assumed that the intense fields approach the orbital moment of the spin moment, and that these two moments repel one another owing to their angular difference. Again, the Curie point in the network of a face-centred cube, where the no. of nearest neighbours is large, depends on the supplementary moment but not on the spin moment. These considerations lead to a general conception of the origin of the positive Curie point and of ferromagnetism. The Curie point Θ is given by the no. N and the intensity F of electronic interactions, $\Theta = F\sqrt{N}$, where N is limited by the magnitude of the supplementary moment if the no. of effective neighbours is large, and by the no. of neighbours if the supplementary moment is large. W. R. A.

Solubility of gases in liquids at low temperatures and high pressures. I. Solubility of hydrogen in liquid nitrogen at 79—109° K. and at pressures up to 190 atmospheres. M. G. GONIKBERG, V. G. FASTOVSKI, and J. G. GURVITSCH (Acta Physicochim. U.R.S.S., 1939, **11**, 865—882).—Apparatus is described. Data are recorded for the composition of liquid and gas phases at 79·0°, 86·1°, 95·4°, and 109·0° K. over the pressure range 0—190 atm. The % solubility of H_2 in liquid N_2 is given by the empirical expression $1/(A - BT)$, where $\log A = 0{\cdot}469 - 0{\cdot}689 \log (p - p^{\cdot}_{N_2})$, and $\log B = -2{\cdot}1197 - 0{\cdot}444 \log (p - p^{\cdot}_{N_2})$ (p and $p^{\cdot}_{N_2}$ are the total gas pressure and the v.p. of liquid N_2, respectively). Formulæ are also given for the relationship between pressure and composition of the phases, and for the change in the position of the max. on the p-composition curve with temp. The system does not follow the laws of dil. solutions over the whole pressure range, but does so over certain limited ranges, in which negative vals. are found for the partial mol. vol. of H_2. F. L. U.

Solubility of sulphur dioxide in water. W. L. BEUSCHLEIN and L. O. SIMENSON (J. Amer. Chem. Soc., 1940, **62**, 610—612).—Partial v.p. for SO_2 in the system SO_2–H_2O have been determined from 20° to 110° and total pressure 10 to 150 cm. for concns. of 0·51, 1·09, 4·36, and 7·45 g. of SO_2 per 100 g. of H_2O, and compared with recorded data. W. R. A.

Ternary system: *iso*propyl alcohol, toluene, and water at 25°. E. R. WASHBURN and A. E. BEGUIN (J. Amer. Chem. Soc., 1940, **62**, 579—581).—Solubility relationships and n vals. have been determined at 25° for the ternary system $Pr^{\beta}OH$–PhMe–H_2O. Comparison with the systems MeOH–PhMe–H_2O (cf. A., 1937, I, 617) and EtOH–PhMe–H_2O (cf. A., 1939, I, 473) shows that the efficiency in bringing about miscibility in PhMe–H_2O systems is in the order $Pr^{\beta}OH >$ EtOH $>$ MeOH. The max. amounts (wt.-%) necessary to produce homogeneity are $Pr^{\beta}OH$ 51, EtOH 57, MeOH 67·5. W. R. A.

Empirical relation between solubility of slightly soluble electrolytes and dielectric constant of the solvent. J. E. RICCI and T. W. DAVIS (J. Amer. Chem. Soc., 1940, **62**, 407—413).—The activity coeff. of a salt in saturated solution is in many instances approx. const. and independent of the dielectric const., ϵ, of the medium. An empirical relation between the solubility of a slightly sol. electrolyte and ϵ of the medium has been deduced, from which the solubility of a given salt in other media can be predicted from the solubility in H_2O without a knowledge of ionic diameters. The calc. and observed solubilities generally are in satisfactory agreement with regard to the order of magnitude at least, and the calc. vals. are as good as those calc. from the Born equation involving estimated ionic diameters. W. R. A.

Influence of dispersity on physicochemical constants. VIII. Influence of dispersity of crystalline substances on electrical conductivity of their saturated solutions. II. IX. Polarographic analysis of barium sulphate solution saturated at 25°. E. COHEN and J. J. A. BLEKKINGH, jun. (Proc. K. Akad. Wetensch. Amsterdam, 1940, **43**, 189—197, 334—339).—VIII. The conductivity of saturated aq. solutions of $BaSO_4$ prepared and purified as previously described (cf. A., 1940, I, 119) is not altered by fine grinding with or without powdered quartz, provided the solution contains no suspended solid. Glass which has once come in contact with finely divided $BaSO_4$ retains an adherent film of the latter, which can be removed only by heating with conc. H_2SO_4.

IX. Measurements of polarograms of saturated aq. $BaSO_4$ (using NMe_4I as auxiliary electrolyte) give the solubility product as $1{\cdot}08 \times 10^{-10}$ at 25°. Assuming complete ionisation the solubility is 2·43 mg. per l. These vals. are unaffected by fine grinding if suspended solid is removed by filtration through a suitable Jena glass filter. F. L. U.

Electronic theory rule on influence of addition elements on polymorphism of iron. H. SCHLECHTWEG (Z. Metallk., 1940, **32**, 18—20).—The following three empirical rules are deduced from theoretical considerations: (1) elements which contain only s electrons in the outer shell and only s and p electrons in the next inner shell are insol. in Fe; (2) elements which have an incomplete p shell restrict the γ-field when the no. of p electrons they contain is small, broaden it when the no. is large, and are insol. in Fe when the p shell is almost closed; (3) elements which have a d shell restrict the γ-field when there is none or only one s electron in the next higher shell and the d shell is $\ngtr$ half filled, broaden the γ-field when there are two s electrons in the next higher shell, and are insol. in Fe when this shell contains p electrons and only one s electron. To conform with these rules Be, Ag, Cd, and Hg must be assumed to have a tendency to exist in a p state. A. R. P.

Effect of temperature on the partition coefficients of saturated monocarboxylic acids between water and benzene. A. BEKTUROV (J. Gen. Chem. Russ., 1939, **9**, 1717—1724).—The partition coeffs., D, have been determined for $EtCO_2H$ (0°, 25°, 60°), Pr^aCO_2H (0°, 25°, 40°, 60°), $Pr^\beta CO_2H$ (0°, 25°, 60°), and $Bu^\beta CO_2H$ (10°, 25°, 40°, 60°). The effect of temp. on D is very small; no regularity is observed in the change in D with rising temp. R. T.

Distribution of boron between liquid and solid phases of the Inder Lake brines during isothermal evaporation. I. N. LEPESCHKOV and A. I. SCHPIKELMAN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 707—708).—The natural brines were evaporated isothermally (25°) and B was determined in the liquid and solid phases. The [B] increases with the brine concn. and none is retained in the solid phase. L. G. G.

Exchange of bromine ions between silver bromide and bromide solution. A. POLESITSKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 668).—Freshly pptd. and coagulated AgBr containing radioactive Br is added to an equiv. inactive KBr solution and the exchange of active Br determined by filtering at intervals and making measurements with a Geiger counter. The procedure is repeated with inactive AgBr and active KBr solution, and the respective loss and gain in activity of the AgBr are plotted against time. The resultant curves show that rapid exchange occurs in the first hour, then falls off, equidistribution of the active Br atoms occurring after about 30 hr. Aged AgBr shows much slower gain from active KBr solution, and fused AgBr none at all. L. G. G.

Inter-solvate exchange of bromine ions in various solvents. S. Z. ROGINSKI and V. E. TARTAKOVSKAJA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **24**, 709—711).—Equal quantities of Br′, one of which is radioactive, are dissolved in the separate solvents of an ultimate binary mixture. The latter is then treated successively with $AgNO_3$ solution equiv. to $\frac{1}{4}$ of the total Br′ in the binary solvent mixture, AgBr being filtered off at each stage and its active Br content determined with a counter. Unequal distribution of the active Br in the successive ppts. from MeOH–, EtOH–, $COMe_2$–, and glycerol–H_2O mixtures is observed despite complete mixture of the two components, and is ascribed to a persistent solvation of Br′ by its "parent" solvent. The H_2O-solvated ions always prevail in the earlier pptns. The effect disappears on heating or long keeping of the binary mixture prior to pptn. and is not shown by mixtures of homologous alcohols. L. G. G.

Absorption of carbon monoxide in solutions of cupric salts in sodium hydroxide. H. MÖLLER and K. LESCHEWSKI (Z. anorg. Chem., 1940, **243**, 269—275).—Solutions of Cu^{II} in presence of $NH_2{\cdot}CH_2{\cdot}CO_2Na$ and excess of NaOH absorb CO, with reduction to Cu_2O and Cu. Formation of formate from CO and NaOH is too slow to play any part in the reaction although it can occur and is facilitated by presence of $Cu(OH)_2$. F. J. G.

Shape of sorption surfaces for adsorption and desorption under various conditions. Experimental. E. WEYDE and E. WICKE (Kolloid-Z., 1940, **90**, 156—171; cf. A., 1931, I, 195, 254).—The surfaces considered are those formed by sorption isotherms in a c, t, x co-ordinate system (c = concn. of

adsorbable gas in gas phase, t = time, x = distance along column of adsorbent in direction of gas stream). The gas used was CO_2 at a partial pressure of 100 mm. in N_2 as a carrier, and the adsorbent was active C. Experimental results are shown in diagrams giving the variation of c with t for a fixed x ("isoplanes"). The slight asymmetry of the adsorption isoplanes is due to lag in the attainment of equilibrium owing to rapid changes of c, whilst the marked asymmetry of the desorption isoplanes is a necessary consequence of the curvature of the isotherms. Over any range in which the isotherms are approx. straight the isoplanes are symmetrical. The steepness of the adsorption surfaces compared with those for desorption is traced to the suppression of turbulence in adsorption, due to removal of the layer in contact with the adsorbent. F. L. U.

Adsorption of gases by active charcoals from the lowest to the highest pressures. A. VON ANTROPOFF [with H. PROPFE, F. KALTHOF, L. SCHMITZ, F. STEINBERG, and L. SCHAEBEN] (Atti X Congr. Internaz. Chim., 1938, II, 89—99).—Adsorption isotherms of N_2, A, and Kr on active C at −79° to 200° and at pressures up to 200 atm. have been measured. With increasing pressure the amount of adsorbed gas passes through a max. which is dependent on the temp. An expression relating the amount of adsorbed gas with d is derived and this is confirmed by the experimental data. O. J. W.

Equilibrium pressures of oxygen adsorbed on active charcoal. M. J. MARSHALL and R. A. FINDLAY (Canad. J. Res., 1940, **18**, **B**, 35—43).—Chemisorbed O on coconut charcoal at 20° has no measurable equilibrium pressure; the small residual pressures observed are due entirely to impurities (N_2 etc.) in the O_2. With increasing concn. of chemisorbed O the rate of chemisorption decreases and becomes zero for a certain limiting concn., beyond which physical adsorption, in true equilibrium with the gas pressure, begins. F. J. G.

Desorption. A. VAN ITTERBEEK and W. VAN DINGENEN (J. Phys. Radium, 1940, [viii], **1**, 25—28).—Using an apparatus which is described, the sp. heats of He and H_2 in the adsorbed state on activated C are 2·14 g.-cal. per mol. at 19·16° K. and 6·48 g.-cal. per mol. at 77·48° K. respectively. The val. for He indicates only two degrees of translational freedom. W. R. A.

Determination of the nature of binding in adsorption media. R. JUZA (Atti X Congr. Internaz. Chim., 1938, II, 276—277).—A summary of magnetic susceptibility (χ) measurements of adsorbed substances. The χ of Br, I, and C_6H_6 adsorbed on C differs from that of the free substances. With Br adsorbed on SiO_2 the effect is less marked. The first quantities of O adsorbed on C do not show the paramagnetism of the O_2 mol. The effect is attributed to the formation of compounds or of excited mols. at the adsorption surface. O. J. W.

Photochemical decomposition of ammonia adsorbed on crystals of copper sulphate and magnesium oxide. V. BELOSELSKI (J. Phys. Chem. Russ., 1939, **13**, 586—592).—From the variation of reaction rate with λ it is inferred that in addition to NH_3 mols. incorporated within the ionic lattice of $CuSO_4$ there is a layer of mols. loosely held on the surface by van der Waals forces, and that on MgO there is both this latter type of adsorption and activated adsorption. In both kinds of adsorption the interat. linkings in the NH_3 mol. are weakened, the more so the more powerful is the adsorption. The energies of dissociation of adsorbed NH_3 have been calc. R. C.

Chemisorption of olefines on nickel. G. H. TWIGG and E. K. RIDEAL (Trans. Faraday Soc., 1940, **36**, 533—537).—Calculations from dimensional data for the Ni lattice and the C_2H_4 mol. show that adsorption of an C_2H_4 mol. to 2 Ni atoms with opening of the double bond is possible with very little distortion. If adsorption is on the (110) plane there is little or no interaction between neighbouring C_2H_4 mols., which can therefore cover the whole surface; this is not true for the higher olefines. These inferences agree with experimental evidence. F. L. U.

New method of studying adsorption and its applications. J. J. TRILLAT (Atti X Congr. Internaz. Chim., 1938, II, 553—570).—An interfacial tensiometer is described which records automatically and continuously the variation with time of the interfacial tension between two liquids one of which contains polar mols. which can be adsorbed at the interface. The curves obtained can be analysed mathematically, and the agreement between theoretical and experimental velocity of adsorption curves is very good. The method is applied in the determination of the oleic acid content of vaseline oil, and in the study of the adsorption of oleic acid by metal, glass, and paper surfaces, of the variation of adsorption with temp., and of the influence of the permanent electric moment of mols. on adsorption. O. J. W.

Adsorptive action of active carbon for the salts of rare earths. E. BOTTI (Atti X Congr. Internaz. Chim., 1938, III, 406—412).—The adsorption of Sm and Gd salts by most forms of active C is $\gg$ that of the other metals, but an adsorption method is suitable only for concentrating a small amount of metals of the Gd series from a mixture of rare-earth metals, and not for effecting a separation of the metals. J. W. S.

Adsorption of radium on lead sulphate. V. CHLOPIN and V. KUSNETZOVA (Acta Physicochim. U.R.S.S., 1939, **11**, 661—678).—The adsorption of $Ra^{\cdot\cdot}$ ions on pptd. $PbSO_4$ has been studied. For reproducibility the solubility, ζ-potential, and sp. surface of the ppt. must be const. in time. When allowance is made for the effect of the small additions of common ions on the solubility of the ppt., the adsorption is independent of the ζ-potential and is thus pure exchange adsorption. F. J. G.

Optical sensitisation and adsorption of dyes on silver halide.—See B., 1940, 326.

Sorption of water by cellulose fibres.—See B., 1940, 268.

Adsorption of dodecanesulphonic acid in the surface of its aqueous solution, and the Gibbs

theorem. J. W. McBain and L. A. Wood (Proc. Roy. Soc., 1940, **A**, **174**, 286—298).—Measurements made by both the microtome and interferometer methods show that positive adsorption occurs in the surface of all dil. aq. solutions of $C_{12}H_{25}\cdot SO_3H$. The surface tension of solutions $<0\cdot01$N. decreases with time for some days, and is a min. at 0·0062N. where the Gibbs theorem would predict zero adsorption. The contradiction between experiment and theory was confirmed by observations on solutions of $C_6H_4Bu\cdot SO_3Na$ and $C_6H_4Bu\cdot SO_3H$. G. D. P.

Adsorption isotherms for mobile monolayers. W. Band (J. Chem. Physics, 1940, **8**, 178—180; cf. A., 1940, I, 159).—Equations are deduced for the gas pressure required to initiate condensation in a monolayer at the interface with a liquid, as a function of temp., and for adsorption isotherms involving unsaturated monolayers, *e.g.*, of fatty acids. L. J. J.

Surface tension of deuterium oxide and of its mixtures with water. R. Indovina (Annali Chim. Appl., 1940, **30**, 51—53).—Data for γ of D_2O–H_2O mixtures (up to D_2O 99·2%) at 20° and 27·8°, obtained by the capillary-ascent method, are tabulated. The val. for D_2O is 6·5% < that for H_2O (cf. Jones and Ray; Timmermans and Bodson, A., 1937, I, 446). F. O. H.

Observations of surface tension in the PLAWM trough. J. W. McBain, J. R. Vinograd, and D. A. Wilson (J. Amer. Chem. Soc., 1940, **62**, 244—248).—The PLAWM trough has been designed to ensure that (i) the surface is static and undisturbed, (ii) it is swept free from contamination, (iii) it is observed for an adequate period, and (iv) evaporation is avoided. The superficial floating barrier is replaced by one which is water-tight yet flexible, and divides the trough into two compartments, one of which may contain H_2O, the other a solution [$CH_2Ph\cdot CH_2\cdot CO_2H$ (I), K laurate (II), $C_6H_4Bu\cdot SO_3Na$ (III), and $C_{12}H_{25}\cdot SO_3H$ (IV) were used]. γ of the aq. (I) is not fully established until after intervals $\gg$ those expected from classical diffusion processes. Curves with a min. are exhibited by aq. (II), (III), and (IV); for these a trace of solute reduces the γ of the solvent, but further small additions raise γ to a still low max. or const. val. With (II), addition of alkali lowers the flat max. to the min. val. The potentialities of the PLAWM trough are discussed. W. R. A.

Surface tensions of methyl acetate solutions. J. W. Belton (Trans. Faraday Soc., 1940, **36**, 493—496).—Vals. of γ with a max. error of 0·3% have been obtained for aq. MeOAc at 25°. Addition of sucrose causes the surface concn. of MeOAc to increase, but this increase is independent of the sucrose concn. Since for a given sucrose concn. the surface concn. of MeOAc increases with its bulk concn. it is inferred that H_2O is displaced from the surface by it. F. L. U.

Surface tension of systems ketones–organic acids. V. V. Udovenko, E. V. Sitschkova, and A. P. Toropov (J. Gen. Chem. Russ., 1939, **9**, 2048—2054).—The surface tension–composition curves of the systems $COMe_2$– or COMePr–R·CO_2H (R = H, Me, Pr) and COMeEt–AcOH, at 25°, 35°, and 45°, deviate positively or negatively from the additive rule; these deviations are ascribed to shrinkage or dilatation of the liquids after mixing, rather than to formation of compounds. R. T.

Liquid drops. L. D. Mahajan (Indian J. Physics, 1939, **13**, 299—304).—A general mathematical relation between the life of drops floating on the surface of the same liquid and the η of the mother-liquid and of the surrounding medium has been deduced; it is applicable to all η and under all conditions. W. R. A.

Boundary lubrication.—See B., 1940, 261.

Theory of formation of protective oxide films on metals. II. N. F. Mott (Trans. Faraday Soc., 1940, **36**, 472—483).—On the basis of the theory previously advanced (A., 1939, I, 574) the rate of growth of oxide films on metals is shown to be governed by a parabolic law when the film is either very thin or very thick, and by a logarithmic law for thicknesses ~30—40 A. Film thicknesses calc. for the case where the work needed to bring an electron from metal to oxide is > that needed to bring a metal ion to an interstitial position in the oxide agree in order of magnitude with experimental data for Hg, Al, Fe, and stainless steel in dry air. The formation of films on alloys and the growth of thick films are discussed. F. L. U.

Crystallisation of thin gold films by electronic bombardment. D. A. Was and T. Tol (Physica, 1940, **7**, 253—254).—Ultramicrophotographs of transparent amorphous Au films on cellulose nitrate and films ~20 mμ. thick without support show crystallisation and increase of particle size on bombardment with electrons of 40 kv. L. J. J.

Monolayers of a long-chain ester sulphate. E. Stenhagen (Trans. Faraday Soc., 1940, **36**, 496—499).—The properties of monolayers of Na docosyl sulphate on aq. substrates are described. On neutral or alkaline substrates the film solidifies at pressures of 2—3 dynes per cm., but at >40 dynes per cm. on 0·01N-HCl. Increase of surface concn. on 0·01N-HCl causes the surface potential to change from negative to positive. F. L. U.

Monolayers of compounds with branched hydrocarbon chains. I. Di-substituted acetic acids. E. Stenhagen (Trans. Faraday Soc., 1940, **36**, 597—606).—Force– and surface potential–area relations have been determined for acids $CHRR'\cdot CO_2H$ containing 14—38 C atoms. Monolayers of the C_{14} acids on 0·01N-HCl are vapour-expanded, and of all the others liquid-expanded. Among isomerides the monolayers become more expanded with increasing symmetry, the expansion being greatest when the substituents are alicyclic rings. Increase in the total no. of C atoms has a condensing effect at low surface pressures, and also at higher pressures if the short chain contains <4 C; otherwise expansion occurs at higher pressures. On substrates having $p_H \nless 11$ all the acids give vapour films, whilst on neutral substrates a relative expansion occurs at low pressures and a contraction at higher pressures. F. L. U.

Solutions of hydrocinnamic acid and of dodecanesulphonic acid studied with the film balance. J. W. McBain and W. V. Spencer (J. Amer. Chem.

Soc., 1940, **62**, 239—244).—Novel results are obtained when the film balance is applied to ordinary solutions (hydrocinnamic, cinnamic, and dodecanesulphonic acids), which bear little relation to previous conceptions derived by analogy with insol. unimol. films floating on H_2O. The various phenomena of surface pressure and time frequently pass through a high max. at intermediate dil. solutions, and the formation of a pellicle depends on both the concn. and the degree of compression of the surface. The final pressure of a pellicle is characteristic only of the substance. Some substances never form a pellicle. W. R. A.

Interaction of gelatin with caseinogen and ovalbumin at surfaces. Electrophoretic behaviour of microscopic particles in presence of horse, human, or rabbit serum.—See A., 1940, III, 343.

Impedance of bimolecular films. R. B. DEAN, H. J. CURTIS, and K. S. COLE (Science, 1940, **91**, 50—51).—Data for a bimol. tanned ovalbumin–lecithin film are recorded and discussed. The resistances of these films are in marked contrast to the low resistances found in untanned protein films, and suggest that complex lipo-protein films may have an appreciable resistance and may be able to produce diffusion potentials in biological systems. L. S. T.

***X*-Ray and optical properties of built-up films.** S. BERNSTEIN (J. Amer. Chem. Soc., 1940, **62**, 374—378).—The discrepancies between *X*-ray and optical measurements of the thicknesses of built-up stearate films (Ba Cu stearate, Cu stearate, Ba stearate) cannot be accounted for by *X*-ray refraction and optical phase change corrections, and must therefore be due to the film structure. Measurements of a set of Ba Cu stearate films show that the film thickness varies greatly with film composition and that a change in the *X*-ray-measured thickness is not accompanied by a change in the optically measured thickness of the same magnitude. Skeletonised and unskeletonised films of the same original composition have the same *X*-ray grating-space. Metal stearate films give only zero layer-line reflexions but an Et stearate film showed additional layer-line reflexions. A suggested film structure is consistent with both the *X*-ray and optical measurements and also with recorded contact potential data. W. R. A.

Membrane permeability. II. Adsorption of sucrose and two salts on cupric ferrocyanide. B. C. McMAHON, E. J. HARTUNG, and W. J. WALBRAN (Trans. Faraday Soc., 1940, **36**, 515—522).—The adsorption of sucrose (I) on pptd. $Cu_2Fe(CN)_6$ (II) is negative, as is also that of NaCl and of Na_2SO_4 except at low concns. The amount of bound H_2O in (II) is independent of (I) concn. Slight cationic, but no anionic, exchange occurs between (II) and the salts. The negative adsorption of the salts is diminished in presence of (I); hence (I) cannot be used to measure the hydration of (II) in presence of salts. A new form of (II) is reported. F. L. U.

Photophoresis, electrophotophoresis, and magnetophotophoresis. F. EHRENHAFT (Ann. Physique, 1940, [xi], **13**, 151—175).—The phenomena, with available data, are described. Observations cannot be wholly explained by radiation pressure and radiometric forces; they are linearly related to field strength (for weak fields) and to light intensity, and are of the same order of magnitude in different gases and liquids. It is considered that the phenomena are manifestations of a force at present unknown and in the nature of a reciprocal action between matter and electromagnetic radiation. N. M. B.

Photographic measurements of the Brownian motion. C. HIRE (Physical Rev., 1938, [ii], **53**, 205).—Photographs of uniform gamboge particles in H_2O showed, in addition to Brownian movement, field vibrations in which all particles moved in the same directions simultaneously. Calculations from the corr. Brownian displacements give 7×10^{23} mols. per g.-mol. for *N*. L. S. T.

Hypermicroscopic determination of shape and size distribution of gold colloids. B. VON BORRIES and G. A. KAUSCHE (Kolloid-Z., 1940, **90**, 132—141; cf. A., 1939, I, 389).—To determine the shape of angular particles with an electron microscope the ratio (r) diameter/resolution of instrument must increase with the no. of angles in the observed plane figure; thus for a hexagon r must be $\nless 7$, but for a dodecagon $\nless 12$. Various preps. of colloidal Au were examined and seen to contain particles having triangular, rhombic, sq., hexagonal and, less often, octagonal faces. The basic form is octahedral, not cubic. Size distribution curves determined with the hypermicroscope correspond with a gaussian distribution, and when the sols are not too highly disperse the mean particle size agrees with that found by direct counting. F. L. U.

Electrothermal dispersion of metals. E. EINECKE (Kolloid-Z., 1940, **90**, 196—201).—The metal to be dispersed is in small pieces (coarse powder or turnings) which rest on an electrode consisting of a sheet of the same metal, while the pieces are kept stirred by a rotating electrode also of the same metal. A.c. at 220 v. is used through an external resistance of 40 Ω. The prep. of colloidal Cu, Mg, Zn, Al, Pb, and Fe in various dispersion media is described. F. L. U.

Nuclear gold sols. III. Lower limit of particle size. A. BAKER and F. L. USHER (Trans. Faraday Soc., 1940, **36**, 549—557; cf. A., 1940, 160). —Previous work on the min. size of Au nuclei is reviewed. Attempts to reduce the size of nuclei by adding adsorbable anions to the reaction mixture were unsuccessful. Progressive dilution of the reacting solutions over an extensive range results in the production of stable nuclei of approx. the size of a unit cell of cryst. Au. The results are in agreement with the view that the formation of colloidal particles from atoms or mols. is a continuous process formally similar to coagulation. No special significance attaches to the terms "nuclei" or "primary particles." F. L. U.

Colloid-chemical processes in separation of calcium hydroxide and saturation with carbon dioxide. O. JANACEK (Kolloid-Z., 1940, **90**, 215—220).—The time required for peptisation of a fixed

amount of cryst. $Ca(OH)_2$ by aq. sucrose (I) decreases with rise of temp. and with increase in (I) concn. The time is further decreased by replacing part of the (I) by *d*-glucose (II), *d*-fructose (III), or invert sugar, but slightly increased by raffinose. The pptn. of pectin by aq. $Ca(OH)_2$ is inhibited by (I), (II), (III), and KCl in increasing order. Data are recorded for the adsorption of (I), (II), (III), and methylene-blue by $CaCO_3$ pptd. from aq. $Ca(OH)_2$ by the passage of CO_2. F. L. U.

Relation between the specific inductive power of hydrated colloids and their hydration. J. T. G. OVERBEEK (Atti X Congr. Internaz. Chim., 1938, II, 390—401; cf. A., 1938, I, 79).—Measurements of ϵ of hydrated colloids at different frequencies are discussed. At $\nu\nu < 10^6$ Hertz both proteins and non-amphoteric colloids (agar, gum arabic) increase the ϵ of the medium (H_2O). There is a direct relationship between the increase in ϵ and the degree of hydration of the colloid. Various explanations are considered. O. J. W.

Determination of the weights of macromolecules. S. BEZZI (Atti X Congr. Internaz. Chim., 1938, II, 116—117).—The accuracy of different methods is compared briefly. O. J. W.

Importance of viscosity in concentrated solution for the determination of the shape and size of particles of highly polymerised substances. H. L. BREDÉE (Atti X Congr. Internaz. Chim., 1938, II, 165—174; cf. A., 1937, I, 303).—The two earlier η–concn. formulæ, containing two material consts., have been modified and shown to hold for conc. solutions of synthetic polymerides. Differences in the η–concn. relationships of natural and synthetic polymerides are discussed. The formulæ given also hold for conc. S sols and emulsions, which have spherical particles. O. J. W.

Lyophilic colloids. E. ANGELESCU (Atti X Congr. Internaz. Chim., 1938, II, 77—88).—Previous work on the η of soap solutions containing cresols is summarised (cf. A., 1940, I, 71 and previous abstracts). Some preliminary measurements of the surface tension and electrical conductivity of similar solutions are also discussed in relation to the solvation and degree of dispersion of the lyophilic colloid. O. J. W.

Relations between electrical conductivity and degree of dispersion of lyophilic colloids. I. General. E. ANGELESCU. **II. Conductivity of solutions of sodium and potassium palmitates and stearates in presence of *o*-cresol.** E. ANGELESCU and A. WOINAROSKY (Bull. Acad. Sci. Roumaine, 1940, **22**, 251—260, 261—272; cf. preceding abstract).—I. Factors influencing the conductivity (μ) of soap solutions are discussed.

II. Determinations of μ for Na and K palmitates and stearates 0·1 and 0·2N. with respect to the soap and in presence of varying amounts of *o*-cresol are recorded. The μ–cresol concn. curves show a max., in agreement with the assumption that addition of cresol increases both the degree of dispersion and the degree of solvation, which influence μ in opposite senses. F. L. U.

Soap solutions. K. HESS (Fette u. Seifen, 1939, **46**, 572—575).—Recent work (cf. A., 1937, I, 514; 1938, I, 309; 1939, I, 469), including that of Kiessig and Philippoff (A., 1940, I, 112), is summarised. F. M. F.

Application of viscosity data to determination of shape of protein molecules in solution. J. M. BURGERS (Proc. K. Akad. Wetensch. Amsterdam, 1940, **43**, 307—315).—Discrepancies in the mol. wt. of proteins deduced from viscosity measurements as compared with that calc. from sedimentation equilibrium are not removed by assuming either that the vol. of the mols. is increased owing to hydration or that they have the form of oblate, instead of prolate, rotational ellipsoids. It is unlikely that the mols. are elongated by the shearing forces present in η measurements, since η is nearly independent of the velocity gradient. F. L. U.

Mutarotation of gelatin. M. P. BALFE (Nature, 1940, **145**, 429).—The optical activity of the sol is derived from the asymmetric C atoms of the protein mols., and in the gel, optical activity due to a dissymmetric arrangement of the protein mols. is superposed. The mutarotation provides additional evidence that the protein mols. form an ordered, rather than a random, structure in the gel. L. S. T.

Viscosity of solutions of denatured and of native egg-albumin. H. B. BULL (J. Biol. Chem., 1940, 133, 39—49).—Extrapolation to zero concn. of the graph relating times of flow of egg-albumin (I) solutions in an Ostwald viscometer with protein concn. intersects the time axis at a val. > the H_2O const. of the instrument after correcting for η of electrolytes present. This discrepancy is greatest at the isoelectric point of the protein and is due to lack of wetting of the glass surface by dil. albumin solutions, the wetting characteristics of the surface film changing abruptly with protein concn. The mol. asymmetry of native, heat-denatured, and $CO(NH_2)_2$-denatured (I) is calc. to be 3·9 : 1, 7·4 : 1, and 9·2 : 1 respectively at p_H 8·00 in 0·02M-PO_4''' buffer from measurements of η. The real diffusion const. of $CO(NH_2)_2$-denatured (I) is 2/3 of that of a spherical mol. of the same mol. wt.; adopting this corr. val., sedimentation measurements give the mol. wt. as 32,000. F. H.

Gelation of magnesium silicate suspensions by carbon dioxide and other agents. R. ROSEMAN, H. EISENBERG, and M. B. LEVIN (J. Amer. Chem. Soc., 1940, **62**, 676).—Passage of CO_2 through fluid suspensions of Mg silicates ($MgO,1·6SiO_2$; $MgO,1·1SiO_2$; $MgO,3·6SiO_2$) causes the suspensions to set. The resulting gels are thixotropic. Traces of HCl, H_2SO_4, and AcOH can be used in place of CO_2 to produce gelation. W. R. A.

Binding of water in manganese dioxide, titanium dioxide, and thorium dioxide hydrates. O. GLEMSER (Z. Elektrochem., 1939, **45**, 820—829).—The distinction of various types of binding of H_2O is discussed (cf. Büll, A., 1936, 423). The capacity method (cf. A., 1938, I, 398) is applied to specimens of the above hydrates, prepared by different methods, and to their partial dehydration products; nearly

all the H_2O is mobile, and consists of capillary and osmotic (zeolitic) H_2O. A small immobile residue, which varies in amount with the mode of prep., is probably bound colloidally, and is liberated as the specimen changes to the cryst. oxide. The f.p. depression of the capillary H_2O indicates that the capillaries are ~100 A. in diameter. An experimental distinction between capillary and zeolitic H_2O is difficult, but a rapid increase of capacity with temp. in the above method shows much loosely-bound H_2O.

A. J. E. W.

Inorganic gels prepared by trituration of hydrated solid salts. T. KATSURAI and M. FUDA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 458—462).—Trituration of solid hydrated salts ($MnSO_4,5H_2O$, $FeCl_3,6H_2O$, $FeSO_4,7H_2O$ + $FeCl_3,6H_2O$, $CoSO_4,7H_2O$, $CuSO_4,5H_2O$) with globules of NaOH in an agate mortar yields very viscous hydroxide gels with evolution of heat. The gels are insol. in H_2O and settle quickly; the sedimentation vol. is < that of the gels prepared in the wet way.

W. R. A.

Time of set of silica gels. IV. Effect of aldehydes and sugars over a p_H range. L. A. MUNRO and J. A. PEARCE (Canad. J. Res., 1939, **17**, **B**, 404—408).—The effects of a series of sugars, aldehydes, and other substances in 0·5M. concn. on the time of set (t) of SiO_2 gels have been investigated over the p_H range 5·5—9·5. Hexoses behave as a group showing little difference between their effects on t. They resemble polyhydric alcohols in increasing t over the whole p_H range. Maltose and sucrose slightly decrease t in acid media but, like the hexoses, t increases with increase in p_H. The aldehydes decrease t in alkaline and increase t in acid media, their behaviour being thus opposite to that of the sugars.

C. R. H.

Constrained syneresis of gelatin gels. I. S. B. AVERBUCH (J. Phys. Chem. Russ., 1939, **13**, 675—678).—Syneresis in contact with Et_2O and COMeEt has been studied. With increase in the time of contact the vol. of H_2O separated passes through a max. The syneresis appears to be accompanied by dehydration of the gel.

R. C.

Elastic properties of gelatin. D. TEODORESCU (Bull. Soc. roum. Phys., 1936, **37**, No. 67, 35—51; Chem. Zentr., 1937, i, 4076).—The shear modulus of gelatin gels, calc. from the rate of drag of a loaded rod through the gel, is $E_f = 1{\cdot}016(c-1)^{2\cdot76}$ dynes per sq. cm. with concns. (c) = 9—21‰, or $0{\cdot}95C^2$ g. per sq. cm. with $C = 2{\cdot}1$—$4{\cdot}0\%$. The change at $C = 2{\cdot}1\%$ is attributed to a structural transition.

A. J. E. W.

Apparent repulsion of antagonistic diffusions of silver nitrate in pure gelatin and dichromated gelatin. (MLLE.) S. VEIL (Compt. rend., 1940, **210**, 434—435; cf. Raman and Ramaiah, A., 1939, I, 470).—Adjacent drops of aq. $AgNO_3$ on a gelatin film produce aureoles which appear to be mutually repulsive, and leave a clear channel perpendicular to the line of centres of the drops. If the gelatin contains $K_2Cr_2O_7$ the channel is clearly defined between Liesegang ring systems; its width is approx. ∝ the square root of the distance between the edges of the drops.

A. J. E. W.

Influence of radiations during corrosion of metals on the destruction of periodic precipitates of $Ag_2Cr_2O_7$ in gelatin. P. F. MICHALEV, A. A. ULJANOV, and F. M. SCHEMJAKIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 32—33).—The radiation given off in the corrosion of metals (*e.g.*, Al and Mg activated by $HgCl_2$) destroys Liesegang rings of $Ag_2Cr_2O_7$ in gelatin. Where the rings are broken large globules of ppt. are formed.

A. J. M.

Electrophoretic mobility and protective action of emulsifiers. A. G. NASINI and A. BALIAN (Atti X Congr. Internaz. Chim., 1938, II, 365—379).—Electrophoresis measurements with aq. emulsions of vaseline and of bitumen oils have been used to study the action of electrolytes (HCl, NaOH, uni-, bi-, ter-, and quadri-valent salts) on unprotected emulsions, the effect of emulsifiers (Na oleate and Na resinate), and the influence of p_H and of other factors.

O. J. W.

Electrokinetic aspects of surface chemistry. VIII. Composition of surface film on fat droplets in cream. L. S. MOYER (J. Biol. Chem., 1940, **133**, 29—38; cf. A., 1940, III, 259).—Milk fat droplets washed with distilled H_2O and suspended in buffer solutions have electrical mobilities different from those of casein under the same conditions and a lower isoelectric point. Unwashed fat droplets do not differ in their behaviour from washed droplets above p_H 5·8 but below this val. the unwashed droplets show an electrokinetic behaviour more nearly identical with that of casein, having a similar isoelectric point. The behaviour of the unwashed droplets is considered to be complicated by the presence of casein, the surface becoming contaminated with casein at a p_H val. at which casein is slightly sol. The isoelectric point of casein diminishes with increasing ionic strength in OAc′ buffers. The data support other evidence for the existence of a complex of phospholipins and a "membrane" protein, different from other known milk proteins, on the fat droplet surface.

F. H.

Elektrokinetics. XXII. Electrokinetic potentials of barium sulphate in solutions of electrolytes and in 50% ethyl alcohol. R. G. RUYSSEN (J. Physical Chem., 1940, **44**, 265—275).—Streaming potentials (ζ) of pptd. negatively charged $BaSO_4$ against H_2O and electrolyte solutions have been determined. In solutions of $BaCl_2$ a reversal of charge on the $BaSO_4$ takes place if [$BaCl_2$] is $> \sim 5 \times 10^{-6}$ mol. per l. No charge reversal takes place in KCl. In 50% EtOH the original val. of ζ is negative and addition of $BaCl_2$, $Ba(NO_3)_2$, $KBrO_3$, and KCl reverses the charge, ζ attaining very high vals.

C. R. H.

Effect of ultra-high-frequency electrical fields on hydrophobic sols. D. I. ERISTAVI and D. N. BARNABISCHVILI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 610—613).—Sols of $Zn_3K_2[Fe(CN)_6]_2$ and $MnK_2Fe(CN)_6$ when exposed to an ultra-high-frequency electrical field undergo changes of cataphoretic velocity and ζ-potential. At low concns. these vals. are < and at high concns. are > vals. for

unexposed sols. When potentiometrically titrated the amounts of $ZnSO_4$ and $MnSO_4$ respectively required to reach the equivalence point are for low sol concns. <, and for high sol concns. >, the amounts required by unexposed sols. It is suggested that during exposure the thickness of the diffuse layer of sol micelles varies and colloid particles of different composition are formed. C. R. H.

Effect of phosphate buffers on the electrical mobility of hæmoglobin. M. H. GORIN, H. A. ABRAMSON, and L. S. MOYER (J. Amer. Chem. Soc., 1940, **62**, 643—644).—Variations in ionic strength of a buffer at const. p_H can affect the electrical mobility of a protein by changing the ion atm., and by changing the charge of the protein, owing to sp. interaction with the ions of the buffer. When both effects are taken into consideration as was previously done for proteins in buffer systems containing only uni-univalent ions (Chem. Reviews, 1939, **24**, 345), the recent data of Davis and Cohn on the electrical mobility of hæmoglobin in phosphate buffers (A., 1939, I, 522) are explained. W. R. A.

Electrokinetic investigations of the lyophilic properties of cellulose derivatives. V. Decrease in viscosity of cellulose nitrate. K. KANAMARU, T. TAKADA, and E. WADA (Kolloid-Z., 1940, **90**, 183—189; cf. A., 1938, I, 456).—A progressive decrease in relative viscosity ($COMe_2$ solution), and a progressive increase in the initial ζ-potential (ζ_0) against H_2O and against EtOH, in the relative decrease of ζ-potential with time $[(\zeta_0 - \zeta_\infty)/\zeta_0]$, in the sorption of H_2O vapour at 80% R.H., and in the heat of sorption for MeOH vapour are shown by cellulose nitrate (N 12·86%) when it is heated with H_2O in an autoclave for increasing times. The results agree with the theory previously advanced (A., 1937, I, 80, 305). F. L. U.

Coagulation of hydrophobic sols by mixed electrolytes. III. Influence of properties of univalent cations. L. LEPIN and A. BROMBERG (Acta Physicochem. U.R.S.S., 1939, **11**, 899—910; cf. A., 1939, I, 563).—On the basis of measurements of coagulation vals. for AgI sols of 2-1-, 2-2-, 3-1-, and 3-2-valent electrolytes in presence of a fixed concn. of a salt of Li, Na, or K, the departure from additivity is shown to be an exponential function of z^2 and $\sqrt{I}$ ($z =$ valency of the multivalent cation, $I =$ ionic strength). For a fixed val. of I the ion antagonism is greatest for $K^{\cdot}$ and least for $Li^{\cdot}$. F. L. U.

Flocculating action of binary systems. I. V. F. UST-KATSCHKINTZEV (J. Gen. Chem. Russ., 1939, **9**, 1887—1898).—In general, the flocculating effect of each of a pair of electrolytes on colloidal systems [S, $Fe(OH)_3$, SnO_2 sols] deviates positively or negatively from the additive rule, depending on whether or not the salts form a complex ion, on whether this has a flocculating or a peptising effect on the colloid, and on whether this effect is > or ≯ that of the simple ions. For these reasons certain ions ($Hg^{\cdot\cdot}$, $Mg^{\cdot\cdot}$) that act similarly when present separately are antagonistic when present together, owing to the function of $HgCl_4''$. These considerations are illustrated by the salt pairs KI–CdI_2, and NH_4Cl–, $MgCl_2$–, and $AlCl_3$–$HgCl_2$. R. T.

Equilibria of reactions between hydrocarbons. XI. Hydrogenation of gaseous paraffin hydrocarbons. V. R. SHARKOVA. **XII. Isomerisation of butylenes and butanes.** A. V. FROST (J. Gen. Chem. Russ., 1939, **9**, 1693—1700, 1813—1818).—XI. The equilibrium coeffs. of the reactions of hydrogenation of C_2H_4, C_3H_6, and isomerides of C_4H_8, at 650—800°, are in good agreement with the vals. calculated from Pitzer's data (A., 1937, I, 557), but not from those of Thomas *et al.* (A., 1938, I, 32).

XII. Pitzer's calc. results (*loc. cit.*) agree with the experimental vals., if the heat of isomerisation of *n*- to *iso*-C_4H_{10} is reduced to -2270 ± 200 g.-cal. R. T.

Equilibrium $2H_2 + CO \rightleftharpoons CH_3OH$. L. M. LASCHAKOV (Acta Physicochim. U.R.S.S., 1940, **11**, 849—860; cf. A., 1939, I, 604).—Using the consts. of the Beattie–Bridgeman equation of state for H_2, CO, and MeOH, sp. vols. of mixtures of various compositions, fugacities of the constituents, and equilibrium concns. of MeOH are calc. F. L. U.

Equilibrium of formaldehyde with glycine. E. BAUR (Helv. Chim. Acta, 1940, **23**, 233—236).—At concn. ≯2M. the equilibrium is $CH_2O + NH_2\cdot CH_2\cdot CO_2H$ (I) $\rightleftharpoons H_2O + CH_2{:}N\cdot CH_2\cdot CO_2H$ (II), no other condensates or polymerides occurring. (II) is largely ionised. The equilibrium const. $[CH_2{:}N\cdot CH_2\cdot CO_2'][H^{\cdot}]/[CH_2O][(I)]$ is ~4 in H_2O at 0°. F. J. G.

Oxidation and reduction equilibria of metals and their ions in solution. R. PIONTELLI (Atti X Congr. Internaz. Chim., 1938, II, 435—441; cf. A., 1938, I, 360).—A further discussion of the general expression previously derived for the equilibrium const. between a metal and its ions in two valency states. The influence on the equilibrium of temp., nature of solvent, and formation of complexes or of undissociated mols. is considered. O. J. W.

Solvolytic reactions of organic halides. M. P. BALFE and J. KENYON (J. Amer. Chem. Soc., 1940, **62**, 445—446).—The assumption of solvation of carbonium ions by covalency formation between the solvent and cation in solvolytic reactions of org. halides is undesirable. W. R. A.

System $AlCl_3$–NaCl. I. Density. II. Viscosity. III. Conductivity. A. I. KRJAGOVA (J. Gen. Chem. Russ., 1939, **9**, 1755—1758, 1759—1763, 2061—2066).—I. The *d*-composition curves suggest a highly dissociated compound. *d* falls linearly with rising temp.

II. The η-composition curves have a well-defined min. for 1 : 1-mol. mixtures. The η-temp. curves conform to the equation $\eta = Ae^{a/T}$.

III. The sp. conductivity is represented by $\kappa = Be^{A/T}$. The max. vals. of sp. and mol. conductivity are given by 1 : 1 mixtures, corresponding with the compound $NaAlCl_4$. R. T.

Conductivity and equilibrium coefficients of certain complex compounds of aluminium bromide in benzene. E. J. GORENBEIN (J. Gen. Chem. Russ., 1939, **9**, 2041—2047).—Mol. con-

ductivity of the complexes $MBr,2AlBr_3$ (M = Na, K, Cu) in C_6H_6 solution falls with increasing dilution. Sp. conductivity rises gradually with increasing concn. up to 25%, above which it rises linearly. The equilibria $(MBr,2AlBr_3)_4 \rightleftharpoons (MBr,2AlBr_3)_2 \rightleftharpoons MBr,2AlBr_3$ are established, for concns. > and <25%, respectively. The conductivity of the complexes varies in the order M = K > Na > Li; Ag > Cu^I. R. T.

Conductivity, viscosity, and surface tension in the system H_2SO_4–$HClO_4$. M. Usanovitsch, T. Sumarokova, and V. Udovenko (J. Gen. Chem. Russ., 1939, **9**, 1967—1975).—Conductivity, η, and surface tension data for the system at 0°, 10°, and 25° do not suggest compound formation. The max. on the conductivity–composition curve is ascribed to lowering of the η of the system with increasing $[HClO_4]$. R. T.

Dissociation of carbonic acid in ordinary and heavy water. G. A. Mills (J. Amer. Chem. Soc., 1940, **62**, 449).—From the smooth curve of $-\log K^H$ against K^H/K^D (where K^H and K^D are the dissociation consts. of H_2CO_3 in H_2O and D_2O) the val. 2·9 is obtained for the ratio, which compares more favourably with 2·68 (the accurately determined ratio of the apparent first dissociation consts. of proto- and deutero-carbonic acids) than with 3·6 (the val. predicted on the basis of the apparent dissociation const.). W. R. A.

p_H of sodium dichromate solutions. Dilution effects. H. J. Kaufmann, W. B. Lauder, and R. K. Kepner (Ind. Eng. Chem., 1940, **32**, 423—426).—The p_H of solutions of $Na_2Cr_2O_7$ falls with increasing concn. to a min. val. at ~2·5 mols. per l. The p_H of the distilled H_2O used, low concns. of NaCl and Na_2SO_4, and slight temp. changes only slightly affect the p_H of the solutions. Solutions in glass vessels tend to increase in p_H, possibly on account of the dissolution of Na_2O from the glass, and SiO_2 vessels are recommended. C. R. H.

Dissociation constants of uric acid. A. L. Bernoulli and A. Loebenstein (Helv. Chim. Acta, 1940, **23**, 245—247).—From potentiometric titration curves at 25°, the dissociation consts. are $K_1 = 4{\cdot}01 \times 10^{-6}$ and $K_2 = 2{\cdot}88 \times 10^{-6}$. F. J. G.

Anomalous strength of *n*-butyric acid. H. O. Jenkins and J. F. J. Dippy (J. Amer. Chem. Soc., 1940, **62**, 483—484).—A linear relation exists between the logarithms of the dissociation consts. of HCO_2H, AcOH, and $EtCO_2H$ and r^{-6} (r = distance separating the C of the CO group and the terminal group of the acid), which predicts a limiting val. for higher acids. In the light of this relationship the abnormality of Pr^aCO_2H is interpreted in terms of the existence of a restricting potential in the mol. This conception conforms with the results of infra-red absorption, Raman spectra, heat capacity, and dipole moment studies. W. R. A.

Ionisation constants of acid–base indicators in ethanol. L. S. Guss and I. M. Kolthoff (J. Amer. Chem. Soc., 1940, **62**, 249—251).—The behaviour of acid–base indicators in EtOH is similar to that in MeOH. At infinite dilution the dissociation curves approach the slope 5·8 required by the limiting Debye–Hückel law. At higher salt concns. the ionic diameter and individual mol. characteristics cause variations. The behaviour of sulphonephthaleins agrees with an extension (cf. A., 1938, I, 621) of the Bjerrum concept. Thus although the shapes of the curves of bromocresol-green are similar for EtOH and MeOH, the former is compressed towards the zero-concn. axis owing to the appearance of the individual effects of the separate charges on a zwitterion at salt concns. ≪ in MeOH. Vals. of the thermodynamic ionisation consts. of the indicators are recorded. W. R. A.

Calculation of activity coefficients in aqueous solutions of strong electrolytes. M. Rolla (Atti X Congr. Internaz. Chim., 1938, II, 459—468).—Using a formula analogous to one previously derived (cf. A., 1934, 254), the activity coeffs. of aq. solutions of KBr, KI, NaBr, NaI, K_2CO_3, and Na_2CO_3 at 25° have been calc. There is good agreement with the experimental vals. O. J. W.

Activity coefficients in concentrated aqueous solutions of strong electrolytes described by a formula containing the mean ionic diameter as single parameter. II. Corrected formulation. P. van Rysselberghe and S. Eisenberg (J. Amer. Chem. Soc., 1940, **62**, 451—452).—A correction and redetermination of vals. (A., 1940, I, 26). W. R. A.

Calculation of solute activities from activities of the solvent. Limiting behaviour of the *h* and *j* functions in dilute solutions. M. Randall and B. Longtin (J. Physical Chem., 1940, **44**, 306—313).—Mathematical. The general nature of the function h/r for various types of deviation from ideal solution laws is discussed. C. R. H.

Approximate rules for solute activities in dilute solutions of non-electrolytes. Generalised form of Bury's rule. M. Randall, W. F. Libby, and B. Longtin (J. Physical Chem., 1940, **44**, 313—321).—Mathematical. An extension of an earlier analysis (cf. preceding abstract). C. R. H.

Activity coefficient of thallous iodate in solutions of alkane-αω-disulphonates. G. C. H. Stone (J. Amer. Chem. Soc., 1940, **62**, 572—575; cf. A., 1936, 589).—Solubilities and activity coeffs. corresponding with different ionic strengths are recorded for $TlIO_3$ in aq. solutions of $SO_3Na{\cdot}[CH_2]_n{\cdot}SO_3Na$ (n = 1—14) at 25° The mean effective at. diameters, calc. for each salt of the series, increase by ~0·25 A. for each additional CH_2, the smallness of the increment being attributed to bending of the mol. in presence of a cation. F. L. U.

Thermodynamics of concentrated aqueous solutions of sodium hydroxide. G. Åkerlöf and G. Kegeles (J. Amer. Chem. Soc., 1940, **62**, 620—640).—The e.m.f. of the cell Pt,H_2|NaOH (m_1)|Na_xHg|NaOH (m_2)|H_2,Pt has been measured over the temp. range 0° to 70° and with [NaOH] from 0·1 to 17M. An equation is given for the activity coeff. of NaOH from 0·1 to 12M. but at >12M. modifications have to be made in the equation. The activity and v.p. of solvent, the relative partial mol. free energy,

heat content, entropy, and heat capacity of both solute and solvent have been calc. The total heat capacity, sp. heat and relative heat content of the solutions, the heat of dilution between two finite concns., differential and integral heats of vaporisation of the solvent, and the effect of pressure on the thermodynamic properties of NaOH are also discussed. The H_2O transfer potentials over the same concn. and temp. ranges have been calc. W. R. A.

Liquid–vapour equilibrium in the system oxygen–krypton. V. G. Fastovski and J. G. Gurvitsch (Acta Physicochim. U.R.S.S., 1939, **11**, 883—898).—Pressures over liquid O_2–Kr mixtures containing up to 50% of Kr have been determined over the interval 90—99° K., and the composition of the vapour is calc. Formulæ are given for the change of total pressure with temp. and composition of the liquid phase, and the vals. of the required coeffs. are tabulated. The system behaves normally. F. L. U.

System benzene–nitrogen. Liquid–vapour phase equilibria at elevated pressures. P. Miller and B. F. Dodge (Ind. Eng. Chem., 1940, **32**, 434—438).—The system C_6H_6–N_2 has been studied at 30—125° and 60—300 atm. Only approx. accordance with Henry's law is observed. At const. temp. the mol. fraction of C_6H_6 in the vapour phase passes through a min. at a pressure which is the higher the higher is the temp. J. W. S.

Liquid–vapour equilibrium relations in binary systems. Ethane–*n*-butane system. W. B. Kay (Ind. Eng. Chem., 1940, **32**, 353—357).—Temp.–composition diagrams for the coexisting liquid and vapour at const. pressure differ considerably at higher pressures from those calc. by the solution laws. The vapour–liquid equilibrium consts. for C_2H_6 in n-C_4H_{10} and in n-C_7H_{16} are recorded for 0—250° F. J. W. S.

Solid solutions of hydrogen peroxide and water. P. A. Giguère and O. Maass (Canad. J. Res., 1940, **18**, **B**, 66—73).—The f.p.–composition diagram of the system H_2O–H_2O_2 has been determined by direct analysis of the solid phases. Solid solutions of H_2O in H_2O_2 and of H_2O_2 in H_2O exist. F. J. G.

Solid mixtures O_2–N_2. A. Prichotko and A. Javnel (Acta Physicochim. U.R.S.S., 1939, **11**, 783—796).—When solidified O_2–N_2 mixtures are warmed from 20·4° K. to the m.p., changes of transparency and of absorption spectra, suggesting phase changes, occur. The temp. of the boundaries of optically-different phases are recorded in the form of an equilibrium diagram. The phenomena may be due to disintegration and rearrangement of tempered mixed crystals. F. J. G.

Behaviour of the amino-group in solid–liquid systems with organic components. K. Hrynakowski and F. Adamanis (Atti X Congr. Internaz. Chim., 1938, III, 202—206).—The results of studies of binary systems of NH_2-compounds with phenols, nitrophenols, and org. acids are summarised. Amines form compounds with phenols when the basic properties are not reduced too greatly by substituents, the formation of these compounds being explained by the sharing of the lone electron pair of the N with a OH group. J. W. S.

Behaviour of azo-compounds and their derivatives in solid–liquid systems in relation to the structure of the azo-group. K. Hrynakowski (Atti X Congr. Internaz. Chim., 1938, III, 197—202).—The binary systems of $(NPh{:})_2$ (I), $(NHPh)_2$ (II), azoxybenzene (III), p-$NH_2{\cdot}C_6H_4{\cdot}N{:}NPh$ (IV), and p-$NMe_2{\cdot}C_6H_4{\cdot}N{:}NPh$ with PhOH, *o*-, *m*-, and p-$C_6H_4(OH)_2$, and α- and β-$C_{10}H_7{\cdot}OH$ have been investigated. No binary compounds are formed in systems containing (I) and (III), whilst (II) forms only the *compound* $(NHPh)_2,2m$-$C_6H_4(OH)_2$. In the other systems the following *compounds* have been detected: p-$NH_2{\cdot}C_6H_4{\cdot}N{:}NPh,PhOH$,
p-$NH_2{\cdot}C_6H_4{\cdot}N{:}NPh,2m$-$C_6H_4(OH)_2$,
$2p$-$NH_2{\cdot}C_6H_4{\cdot}N{:}NPh,p$-$C_6H_4(OH)_2$,
p-$NH_2{\cdot}C_6H_4{\cdot}N{:}NPh,2p$-$C_6H_4(OH)_2$,
$2p$-$NH_2{\cdot}C_6H_4{\cdot}N{:}NPh,\alpha$-$C_{10}H_7{\cdot}OH$,
p-$NMe_2{\cdot}C_6H_4{\cdot}N{:}NPh,PhOH$,
$2p$-$NMe_2{\cdot}C_6H_4{\cdot}N{:}NPh,\alpha$-$C_{10}H_7OH$. The results accord with the view that the ·N:N· group is fully saturated and that the Hantzsch formula represents the structure of the salts of (IV). No intermol. compounds are formed between (I), (II), and (III) and no two of these compounds are isomorphous. J. W. S.

Molecular compounds in binary systems: benzoic acid and nitro-, hydroxy-, and amino-benzoic acids. E. Vitale (Atti X Congr. Internaz. Chim., 1938, III, 380—390).—Thermal analysis of mixtures of BzOH (I) with *o*-, *m*-, and p-$C_6H_4X{\cdot}CO_2H$ ($X = NO_2$, OH, or NH_2) confirms the formation of a compound (I),m-$NO_2{\cdot}C_6H_4{\cdot}CO_2H$, m.p. 139°, and shows the formation of *compounds* (I),o-$NO_2{\cdot}C_6H_4{\cdot}CO_2H$, m.p. 121°, (I),$p$-$NO_2{\cdot}C_6H_4{\cdot}CO_2H$ (unstable; dissociates at ~185°), and (I),o-$NH_2{\cdot}C_6H_4{\cdot}CO_2H$ (unstable). The system (I)–p-$OH{\cdot}C_6H_4{\cdot}CO_2H$ could not be studied owing to decomp. of the second component. In the other systems, mol. compounds are not observed. E. W. W.

Thiosilicates and thioaluminates of heavy metals. G. G. Monselise (Atti X Congr. Internaz. Chim., 1938, II, 732—736; cf. A., 1937, I, 141).—A thermal study of the system Tl_2S–SiS_2 shows the existence of $4Tl_2S,3SiS_2$ (violet-red, m.p. 589°, d_4^{25} 7·450) and probably also of $Tl_2S,4SiS_2$. O. J. W.

Partial vapour pressures from nicotine solutions at 25°. L. B. Norton, C. R. Bigelow, and W. B. Vincent (J. Amer. Chem. Soc., 1940, **62**, 261—264).—The partial v.p. of nicotine and H_2O over their binary solutions at 25° show large positive deviations from Raoult's law but agree with the Duhem equation. Activity coeffs. of nicotine in dil. solutions decrease rapidly with increasing concn. As the concn. of nicotine increases its loss by evaporation relative to that of H_2O first increases rapidly, then remains const., and finally increases very rapidly. W. R. A.

System sodium iodide–water. T. R. Briggs and W. F. Geigle (J. Physical Chem., 1940, **44**, 373—377).—Additional data on the system NaI–H_2O at temp. <0° have been obtained and used in con-

junction with published data to construct the phase diagram. C. R. H.

Reduction equilibrium of chromic oxide. G. GRUBE and M. FLAD (Z. Elektrochem., 1939, **45**, 835—837).—The equilibrium $2Cr + 1 \cdot 5O_2 \rightleftharpoons Cr_2O_3$ is studied by measuring the temp. at which a mixture of H_2 and H_2O vapour is in equilibrium with partly reduced Cr_2O_3, and hence deriving the equilibrium O_2 pressure ($7 \cdot 4 \times 10^{-25}$, $5 \cdot 1 \times 10^{-23}$, $3 \cdot 8 \times 10^{-22}$ atm. at 895°, 968°, and 1002°, respectively). *X*-Ray and chemical analysis show that the reduction product is Cr, not a lower oxide. For the oxidation $\Delta H = -279 \cdot 7$ kg.-cal. at 968—1002°. A. J. E. W.

Preparation of solid chromium–nickel alloys by reduction of chromic oxide in presence of nickel. G. GRUBE and K. RATSCH (Z. Electrochem., 1939, **45**, 838—843).—Qual. experiments have shown that Ni–Cr, Fe–Cr, Co–Cr, Ni–Nb, and Fe–V alloys can be prepared by reduction of Cr_2O_3, Nb_2O_5, or V_2O_5 with H_2 in presence of Ni, Fe, or Co. Ni–TaO_2 and –SiO_2 are partly reduced, but no reduction occurs with Ni–ThO_2, –ZrO_2, –Al_2O_3, or Fe–ThO_2. The alloys formed are slightly porous. The equilibria are studied in detail for Ni and Cr_2O_3 by determination of the equilibrium O_2 pressure (*p*; cf. preceding abstract) over the mixture at 1100°, 1200°, and 1300°, with the equilibrium composition of the alloy. At first *p* falls rapidly with increasing [Cr] in the alloy, but the curve bends over to become horizontal in the miscibility gap. A. J. E. W.

Equilibrium $FeO + H_2 = Fe + H_2O$ at temperatures up to the m.p. of iron. J. CHIPMAN and S. MARSHALL (J. Amer. Chem. Soc., 1940, **62**, 299—305).—The equilibrium $FeO + H_2 = Fe + H_2O$ has been determined from 1200° to 1515°. Below the m.p. of FeO an equation is given which represents the new data and those of Emmett and Shultz (A., 1932, 1090) and Jominy and Murphy (A., 1931, 567). Above the m.p., $K = P_{H_2O}/P_{H_2}$ is given by $\log K = 1583/T - 1 \cdot 021$. The m.p. of the equilibrium oxide is 1369° and the heat of fusion 10,000 g.-cal. per mol. The m.p. of O_2-free and O_2-saturated Fe are 1535° and 1524°, respectively. W. R. A.

Calculation of free energies of formation from ternary equilibrium diagrams. F. HALLA (Z. physikal. Chem., 1940, **185**, 426—434).—The method (cf. A., 1936, 290) of calculating ΔF° for AB from the concn. of solution phases in equilibrium with AB + A and with AB + B is extended to a no. of intermetallic systems. F. J. G.

Vapour–liquid equilibria in ternary systems. I. Course of the distillation curves. W. REINDERS and (MISS) C. H. DE MINJER (Rec. trav. chim., 1940, **59**, 207—230).—Theoretical. Various possible cases are discussed, and reference is made to examples from the literature. F. J. G.

Application of physico-chemical analysis to study of equilibrium of liquid phases in three-component systems. II. Formation of two liquid phases in systems acetic acid–methylaniline–benzine and acetic acid–dimethylaniline–benzine. E. F. SHURAVLEV (J. Phys. Chem. Russ., 1939, **13**, 679—683; cf. A., 1939, I, 473).—The miscibility curves at 20—45° have been determined. R. C.

Stratification in ternary systems. IV. System water–ether–acid. V. F. UST-KATSCHKINTZEV and P. A. CHLEBNIKOV. **V.** V. F. UST-KATSCHKINTZEV (J. Gen. Chem. Russ., 1939, **9**, 1742—1748, 1749—1751).—IV. Phase diagrams are given for the systems H_2SO_4–Et_2O–H_2O, at −10°, 0°, and 20°, and H_3PO_4–Et_2O–H_2O, at 0°. The results confirm the rule that a component forming compounds with each of the other two components of a ternary system raises the mutual solubility of each pair of components.

V. Regions of mutual solubility are determined for the system PhOH–$NHPh \cdot NH_2$–H_2O, at 20—114°. The system has an upper crit. point (19% $NHPh \cdot NH_2$ and 18% PhOH, at 113—114°), due to formation of the compound PhOH,$NHPh \cdot NH_2$. R. T.

Polyiodides of ammonium. I. Ammonium iodide and iodine. T. R. BRIGGS and K. H. BALLARD. **II. Ternary system ammonium iodide, iodine, water.** T. R. BRIGGS, K. H. BALLARD, (MISS) F. R. ALRICH, and J. P. WIKSWO (J. Physical Chem., 1940, **44**, 322—324, 325—350).—I. The temp.–composition diagram of the system NH_4I–I is similar to that of the system RbI–I (cf. A., 1932, 1216). The solubility of NH_4I in liquid I varies only slightly with temp.

II. Elaborate isothermal and polythermal studies of the system NH_4I–I–H_2O have been made. The solid phases are ice, NH_4I, I, NH_4I_3 (m.p. 175°), $NH_4I_3,3H_2O$ (m.p. 7·0°), and, possibly, NH_4I_5,H_2O (m.p. 9·8°). Each of the polyiodide m.p. is incongruent. As regards the tendency to form hydrated polyiodides, NH_4 is midway in the series Cs < Rb < NH_4 < K < Na < Li. C. R. H.

Polyiodides of potassium. II. Ternary system potassium iodide–iodine–water. T. R. BRIGGS, K. D. G. CLACK, K. H. BALLARD, and W. A. SASSAMAN (J. Physical Chem., 1940, **44**, 350—372).—Elaborate isothermal and polythermal studies of the system KI–I–H_2O have been made. The solid phases are ice, KI, I, KI_3,H_2O (m.p. 30°), KI_7,H_2O (m.p. 38°), and α- and β-$KI_3,2H_2O$ [transition point 1°, m.p. (β) 12·3°]. These m.p. (incongruent) and transition point are deduced from the phase diagram and have not been experimentally determined. C. R. H.

System NH_4Cl–NaCl–H_2O at 25°, 50°, and 100°. S. RESTAINO (Atti X Congr. Internaz. Chim., 1938, II, 761—766).—Triangular diagrams obtained from solubility measurements show that in the above temp. range the only solid phases which can exist are the anhyd. salts. O. J. W.

System $CaCl_2$–$Ca(NO_3)_2$–H_2O at 25°, 50°, and 100°. C. RANAUDO (Atti X Congr. Internaz. Chim., 1938, II, 756—761).—Equilibrium diagrams obtained from solubility measurements are given. The solid compounds which can exist are: at 25°, $Ca(NO_3)_2,4H_2O$; $CaCl_2,Ca(NO_3)_2,4H_2O$; $CaCl_2,4H_2O$; $CaCl_2,6H_2O$; at 50°, $Ca(NO_3)_2,2H_2O$;

$CaCl_2,Ca(NO_3)_2,2H_2O$; $CaCl_2,2H_2O$; at 100°, $Ca(NO_3)_2$; $CaCl_2,Ca(NO_3)_2,2H_2O$; $CaCl_2,2H_2O$. O. J. W.

System calcium oxide–silica–water at 30°. Association of silicate ion in dilute alkaline solution. P. S. Roller and G. Ervin, jun. (J. Amer. Chem. Soc., 1940, **62**, 461—471).—Hydrated Ca silicates are gelatinous. The ratios of $CaO : SiO_2$ in the solid phase, and of $[CaO] : [SiO_2]$ in solution at 30·2°, have been measured. Four phase ranges were distinguished, in two of which the concns. were invariant. The solid phases adsorb CaO throughout. From consideration of the adsorption isotherm and the solubility product const., the compositions of the hydrated compounds are (i) CaO,SiO_2 (CaH_2SiO_4), (ii) $3CaO,4SiO_2$ [$Ca_3(HSi_2O_6)_2$], (iii) $CaO,2SiO_2$ ($CaH_2Si_2O_6$). The invariant concns. in mmol. per l. for the mixture of (i) and (ii) were CaO 3·09, SiO_2 0·090, and for the mixture of (ii) and (iii) CaO 0·900, SiO_2 0·931. The assumed exclusive presence of the simple ions H_2SiO_4'' and H_3SiO_4' is inconsistent with the existence of the only alternatives of $Ca(H_3SiO_4)_2$ or any reasonable double compounds of this with CaH_2SiO_4. It is therefore necessary to assume that association takes place in the dil. alkaline solutions. The postulate of two sets of ions, based on an association equilibrium between H_3SiO_4' and $H_2Si_2O_6''$, leads to concordant results. W. R. A.

System $CaO–CaF_2–Ca_2SiO_4$. W. Eitel (Atti X Congr. Internaz. Chim., 1938, II, 631—632).—The ternary diagram obtained from thermal measurements is given. O. J. W.

Application of the method of sections to the study of equilibrium in ternary systems with solid phases. K. I. Motschalov (J. Gen. Chem. Russ., 1939, **9**, 1701—1706).—The phase diagram of a ternary system may be constructed from curves connecting the amount of one component added to a series of mixtures of the other two with the n of the liquid phase. This is illustrated by the system H_2O–MeOH–NH_4Cl, at 17°. R. T.

Pressure gradient fractionation of gases. J. W. Creely and G. C. Le Compte (Ind. Eng. Chem., 1940, **32**, 430—434).—Theoretical. Equations are derived to express the distribution of a multi-component gas between a solvent and gaseous phase, and the conditions for pressure-gradient fractionation and perfect countercurrent continuous pressure-gradient fractionation of such mixtures are deduced. J. W. S.

Carbide studies by the methane-carbonisation method. IV. Double carbides. R. Schenck and K. Meyer (Z. anorg. Chem., 1940, **243**, 259—268).—800° isothermals of the $CH_4–H_2$ equilibrium over Fe–W mixtures, and a model of the 800° isothermal for the whole system, are given. In addition to $Fe_6W_6C_5$ (I), a double *carbide* $FeW_{23}C_7$ is indicated. (I) is a compound of Fe_3C and W_2C, and is stable at 800°, although its component carbides break up into graphite and mixed crystals. F. J. G.

Reaction of aluminium with siliceous slags. F. Weibke and E. Frey (Z. Elektrochem., 1939, **45**, 807—812).—The equilibrium $4Al + 3SiO_2 \rightleftharpoons 2Al_2O_3 + 3Si$ has been studied by analysis after heating previously sintered mixtures of coarse Al powder and $Na_2SiO_3–SiO_2$ slag (25—40% Na_2O) at 1280—1300°. The Al content of the melt becomes approx. const. after 2—2·5 hr. The wt. of Si formed after 30 min. heating is approx. $\propto$ the wt. of Al in the initial mixture, and if SiO_2 is in excess the Al–Si alloy produced has approx. const. composition. The equilibrium const. ($K = 0·04—0·16$) is independent of the Na_2O content of the slag. The wt. of Al produced on heating Al_2O_3–Si mixtures at 1580—1600° for 15—90 min. increases with the wt. of Si taken, confirming the existence of an equilibrium; the very high K vals. indicated by these experiments provide some evidence for the existence of lower oxides of Al or Si. A. J. E. W.

Equilibria in the systems $CH_2R·OH–R·CHO–R·CO_2H–R·CO_2CH_2R$. I. Influence of the nature of the radical R. M. M. Koton (J. Gen. Chem. Russ., 1939, **9**, 2244—2247).—The possible reactions in the system are: $CH_2R·OH + R·CHO \rightarrow OH·CHR·O·CH_2R$ and $CHR(O·CH_2R)_2$; $R·CO_2H + CH_2R·OH \rightleftharpoons R·CO_2CH_2R$; $OH·CHR·O·CH_2R + O \rightarrow R·CO_2CH_2R$; $R·CHO + O \rightarrow R·CO_2H$. These reactions are catalysed by Cu–Zr. The chief product is ester when R = H, acetal when R = Me, and ester and acid in equal amounts when R = Pr^β or Bu^β. R. T.

Systems alkali oxide–$CaO–Al_2O_3–SiO_2–CO_2$. X. Equilibria in the quaternary system $Na_2O–CaO–SiO_2–CO_2$. C. Kröger and K. W. Illner (Z. anorg. Chem., 1940, **243**, 209—230; cf. A., 1939, I, 420).—Reaction pressures for mixtures of $Na_2Ca(CO_3)_2$ with SiO_2 and Ca and Na silicates and double silicates have been determined, and certain equilibria are identified and recorded in a p–T diagram for the quaternary system. F. J. G.

Heat of formation of aluminium sulphide. I. A. Korschunov (J. Phys. Chem. Russ., 1939, **13**, 703—704).—The val. $\Delta H_{298·1} = -121,550$ g.-cal. has been obtained. R. C.

Heats of formation of ethyl and propyl peroxides. E. C. Stathis and A. C. G. Egerton (Trans. Faraday Soc., 1940, **36**, 606).—The following heats of combustion ($-\Delta H_{298}$) have been determined: Et_2O_2 7155, EtO_2H 5400, PrO_2H 6300, all ± 200 g.-cal. per g. at 1 atm. The heats of formation of the vapours derived from these results differ little from the vals. for the corresponding ether and alcohols. F. L. U.

Heats of formation and dissolution of hydrogen chloride, bromide, and iodide. W. A. Roth, E. Boerger, and H. Siemonsen (Atti X Congr. Internaz. Chim., 1938, II, 775—784; cf. A., 1937, I, 413, 518).—Some further data are recorded. O. J. W.

Heat of combustion of benzophenone. A. I. Tschalenko (J. Gen. Chem. Russ., 1939, **9**, 1915—1920).—The heat of combustion is 8550·0 g.-cal., at 25°. The val. does not change with time after prep. of a sample, and the hygroscopicity of $COPh_2$ is too small to affect the results. R. T.

Heat of oxidation of iodide ion by potassium dichromate. T. V. Ass, A. C. Batalin, and I. A.

SCHTSCHERBAKOV (J. Phys. Chem. Russ., 1939, **13**, 687—689).—The heat of the reaction $KI + K_2Cr_2O_7 + H_2SO_4$ (1) is 28,000 g.-cal. per g.-atom of I and that of $KI + K_2Cr_2O_7 + HCl$ (2) 26,000 g.-cal. (1) but not (2) is kinetically unimol.
R. C.

Heats of dissolution, heats of formation, specific heats, and equilibrium diagrams of certain molecular compounds. A. N. CAMPBELL and A. J. R. CAMPBELL (J. Amer. Chem. Soc., 1940, **62**, 291—297).—Heats of dissolution (solvent in parentheses) and sp. heats have been determined for reactants and products in the systems PhOH–$CO(NH_2)_2$ (H_2O), PhOH–*p*-toluidine (EtOH), β-$C_{10}H_7 \cdot NH_2$–$NMe_2 \cdot C_6H_4 \cdot NO$ ($COMe_2$), and *o*-$OH \cdot C_6H_4 \cdot CO_2H$–$NH_2Ac$ (EtOH). From these data the heats of formation of the mol. compounds at room temp. and 0° K. have been calc. Equilibrium diagrams for the systems PhOH–$CO(NH_2)_2$–H_2O and NH_2Ac–*o*-$OH \cdot C_6H_4 \cdot CO_2H$–$H_2O$ at 20° have been investigated and indicate that both mol. compounds are stable. W. R. A.

Heat of dilution of aqueous hydrochloric acid at 25°. J. M. STURTEVANT (J. Amer. Chem. Soc., 1940, **62**, 584—587).—The heat of dilution of aq. HCl at 25° has been measured for solutions up to 3·3M. and the apparent and relative mol. heat content of the solute and the relative mol. heat content of the solvent have been deduced. W. R. A.

Variation of the differential heat of dissolution of normal organic substances in their dilute aqueous solutions at constant temperature and as a function of concentration. J. PERREU (Compt. rend., 1940, **210**, 293—295).—Data for 7 non-electrolytes at 12° show that ΔQ_c, the difference between the differential mol. heats of dissolution of a substance A (mol. wt. M) in a solution containing p g. of A per 100 g. of H_2O (Q_c) and in H_2O, is given by $\Delta Q_c/M = \Delta q_c = Kp/100M$. For dil. solutions K is the cryoscopic const. for H_2O. Q_c may be determined using another solute which does not react with A. M can be determined from measurements of Δq_c. A. J. E. W.

Heat of hydration of calcium sulphates. J. C. SOUTHARD (Ind. Eng. Chem., 1940, **32**, 442—445).—The heats of hydration of several varieties of $CaSO_4$ (I) and $CaSO_4,0{\cdot}5H_2O$ (II) have been determined. Vals. at 25° are: sol. (I) -7210 ± 10; natural (I) -4040 ± 20; stable cryst. (II) -4100 ± 20; metastable (II) -4600 ± 20 g.-cal. per g.-formula wt. Heat of dissolution measurements show that commercial hard wall plaster is a mixture of stable and metastable (II), and that casting plaster is almost entirely stable (II).
C. R. H.

Electrostatic effects on ionisation constants. V. K. LAMER and F. BRESCIA (J. Amer. Chem. Soc., 1940, **62**, 617—620).—The heat of dissociation ΔH of AcOD and AcOH is represented accurately as a function of temp. by $\Delta H_T = \Delta H_x + c/D_T[1 + T(\partial \log_e D/\partial T)]$ where $\Delta H_x = 2260$ (2030) and $c = 4{\cdot}410$ (4·714) $\times 10^5$. ΔC_p is almost zero for an acid–base exchange reaction involving D_2 and H_2 in D_2O and in H_2O, since the radii of the ions and the dielectric properties of the two media are almost identical. The difference in the heats of ionisation of AcOD and AcOH is apparently a function only of the temp. of the max. dissociation const. W. R. A.

Heat effect of partition between two phases. S. S. EIGENSON (J. Gen. Chem. Russ., 1939, **9**, 1926—1927).—Polemical against Perschke and Lakedemonski (A., 1939, I, 373). R. T.

Thermochemistry of chelation. R. MANZONI-ANSIDEI and T. STORTO (Atti X Congr. Internaz. Chim., 1938, II, 324—335).—Heats of combustion for a no. of hydroxy- and methoxy-benzaldehydes are recorded. Energies of formation and resonance are calc. and compared with those of other mols. The thermochemical evidence does not confirm the existence of chelation in *o*-$OH \cdot C_6H_4 \cdot CHO$. O. J. W.

Heats of wetting at various temperatures and wetting affinity. B. V. ILJIN and A. V. KISELEV (J. Phys. Chem. Russ., 1939, **13**, 660—674).—Heats of wetting, q, of SiO_2 gel and C with various liquids have been measured at 15—100° with a new type of adiabatic calorimeter. In most cases q varies little, if at all, with the temp., T, and in most of the other cases q falls with rise of T. The temp. coeff. of q shows the effect of variation of T on q to be similar to that on heats of adsorption and heats of "wetting" of H_2O by org. liquids. For most systems the affinity of wetting falls linearly with T. R. C.

Third law entropy of ethyl chloride. J. W. LINNETT (Trans. Faraday Soc., 1940, **36**, 527—533).—The entropy (S) of EtCl between 0° and 300° has been calc. on the assumption of free and on that of restricted rotation of the Me group. From these results and the calc. S of C_2H_4 and HCl ΔS has been calc. for the same temp. range, but the val. so obtained differs greatly from the experimental val. for 200° deduced from the equilibrium data of Rudkovskii *et al.* (A., 1936, 159), whence it is inferred that the latter are in error. F. L. U.

Heat capacity and thermodynamic properties of iron carbide.—See B., 1940, 280.

Electrical conductivity of molten carnallite. A. A. SCHTSCHERBAKOV and B. F. MARKOV (J. Phys. Chem. Russ., 1939, **13**, 621—630).—The conductivities of molten NaCl and KCl and of KCl–NaCl, NaCl–$MgCl_2$, and KCl–$MgCl_2$ mixtures have been measured at 660—820°. The form of the isotherms for KCl–$MgCl_2$ mixtures points to a complex equilibrium in the melt. Measurements have been made with the system KCl–$MgCl_2$–NaCl in the concn. region of 5—35 mol.-% of $MgCl_2$ and 10—50 mol.-% of KCl. A new type of conductivity cell for high-temp. measurements is described. R. C.

Electrical conductivity of binary liquid systems. E. ANGELESCU (Atti X Congr. Internaz. Chim., 1938, II, 71—77; cf. A., 1936, 1331).—The conductivities (μ) of binary systems containing varying proportions of an aromatic amine (*o*- and *m*-$C_6H_4Me \cdot NH_2$, NH_2Ph) and of a fatty acid (HCO_2H, AcOH, $EtCO_2H$, $BuCO_2H$) have been measured at 25°. All systems show a max. μ at concns. which differ from those at which max. were previously found in the η–concn. and vol. contraction–concn. curves.

For some of the systems, however, the product $\eta\mu$ is a max. for the same mixtures which have a max. vol. contraction. O. J. W.

Negative temperature coefficients of the electrical conductivity of solutions. M. USANOVITSCH (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 608—609).—From a consideration of the temp. coeffs. of η and conductivity (κ), it is shown that a negative val. for $d\kappa/dT$ is more likely when $d\eta/dT$ is small, and since, by observation, $d\eta/dT$ is small when η is small, it follows that a negative val. for $d\kappa/dT$ must be observed in solutions of low η. This conclusion is confirmed by data for non-aq. solvents. C. R. H.

Conductance of electrolytes in heavy water. R. INDOVINA (Annali Chim. Appl., 1940, **30**, 54—61).—The equiv. conductance of HCl in D_2O–H_2O mixtures at 25° does not vary linearly with the D_2O concn.; the greatest deviation (—7·3%) occurs with 40% of D_2O. The mobilities of $K^{\cdot}$, $NO_3{}'$, $SO_4{}''/2$, $Ba^{\cdot\cdot}/2$, and $Cu^{\cdot\cdot}/2$ are calc. F. O. H.

Conductivity of some salts in chlorobenzene at 25°. R. L. MCINTOSH, D. J. MEAD, and R. M. FUOSS (J. Amer. Chem. Soc., 1940, **62**, 506—508).—Conductivity data are recorded for $NHBu^{a}_3$ and NBu^{a}_4 picrates and NBu^{a}_4Br in PhCl at 25°. In dil. solution the conductivity curves approach a straight line of slope —0·5, indicating a simple binary equilibrium. That of the bromide shows a broad min. The effective ion sizes of the quaternary salts in PhCl are ~1 A. < in other solvents. This indicates that sp. interaction between solvent and solute can appear even for strong electrolytes. W. R. A.

Conductance of salts in monoethanolamine. H. T. BRISCOE and T. P. DIRKSE (J. Physical Chem., 1940, **44**, 388—397).—The conductivities (Λ) at 25° of $NH_2\cdot[CH_2]_2\cdot OH$ solutions of NH_3Me, NH_2Me_2, $NHMe_3$, and NMe_4 picrate and chloride and of $N(iso\text{-}C_5H_{11})_4$ picrate (I), iodide, and nitrate are recorded. With one exception the experimental slopes of the Λ–$\sqrt{C}$ curves are much steeper than those predicted from Onsager's equation. Only for NMe_4Cl do the two slopes approach each other. The lack of agreement is partly accounted for by the failure of the Onsager equation to account fully for effects. The Debye–Hückel equation gives vals. for activity coeffs. in good agreement with experimental vals. Vals. for Λ of dil. solutions of (I) in $NH_2\cdot[CH_2]_2\cdot OH$–dioxan mixtures show that Λ decreases with decreasing dielectric const., and approaches a min. with increasing concn. C. R. H.

Conductance of solutions of organo-substituted ammonium chlorides in liquid hydrogen sulphide. E. E. LINEKEN and J. A. WILKINSON (J. Amer. Chem. Soc., 1940, **62**, 251—256).—The conductivities of solutions of mono-, di-, tri-, and tetra-methyl-, -ethyl-, and -*n*-propyl-ammonium chlorides have been measured in liquid H_2S. The mol. conductivities (μ) increase both with the no. and size of the substituent groups, the no. being the more significant factor. The μ–concn. curves generally show min., characteristic of solutions of electrolytes in solvents of low dielectric const. NH_2Et_2Cl and $NH_2Pr^{a}_2Cl$, which do not give such a min., would be expected to show increased μ in more conc. solutions, but in fact do not. W. R. A.

Electrochemical studies with diaphragms. IV. Transport of ions through double diaphragms. A. I. JURSHENKO and G. N. SKRINNIKOVA (J. Gen. Chem. Russ., 1939, **9**, 2184—2190).—The transport no. of the Cl′ ion through a double porcelain–gelatin diaphragm is equal to that of a single diaphragm of the material with the smaller pores, but also varies according to the direction of the current. R. T.

Rôle of electrons in certain physico-chemical phenomena. N. V. KARPEN (Bull. Acad. Sci. Roumaine, 1940, **22**, 273—279; cf. A., 1940, I, 75).—The cell comprising two similar metal electrodes in contact with two adjoining electrolyte solutions which contain no ions of the metal is discussed from the viewpoint of the author's theory (cf. *ibid.*, 119). $H^{\cdot}$ and OH′ concn. cells and O_2, H_2, and Cl_2 gas cells are discussed in detail. J. W. S.

Origin of electrolytic solution tension. A. QUARTAROLI (Atti X Congr. Internaz. Chim., 1938, II, 442—445).—The enormous solution tension of certain metals is probably related to the repulsive force which exists between ions at very small distances and varies inversely as some high power of the distance. O. J. W.

Electromotive behaviour of nickel in presence of hydrogen. II. B. FORESTI (Atti X Congr. Internaz. Chim., 1938, II, 226—235; cf. A., 1937, I, 519).—At p_H >4·8 Ni-black|H_2 electrodes assume the same potential as Pt-black|H_2 electrodes, whereas at p_H <4·8 they are slightly less noble. Electrolytic Ni|H_2 electrodes are slightly more noble than Pt|H_2 in the p_H range 1·2—12·25, but the difference is smallest at p_H >6·2. The behaviour of the electrodes as Ni–H alloys containing a high surface concn. of active H is discussed. O. J. W.

Electrolytic potential of Raney nickel. A. TRAVERS and J. AUBRY (Atti X Congr. Internaz. Chim., 1938, II, 546—553).—At p_H 5—14 and in a stream of H_2 the potential of Raney Ni is nearly that of a reversible H electrode. In the pressure range 1—100 atm. the Raney Ni electrode is also reversible. Below p_H 5 the potential is more negative than that of a Pt|H_2 electrode. Identical results were obtained with Ni electrodes covered with electrolytic spongy Ni and saturated with H cathodically. O. J. W.

Application of electromotive force measurements to binary metal systems. H. SELTZ (Trans. Electrochem. Soc., 1940, **77**, Preprint 17, 219—243).—E.m.f. measurements of the binary liquid metal systems Pb–Bi, Cd–Sb, and Zn–Sb are recorded. Thermodynamic properties have been evaluated and applied to the calculation of phase equilibria and of entropies, free energies, and heats of formation of intermetallic compounds. The data are discussed with reference to available data for the systems. C. R. H.

Potentiometric method for the accurate measurement of hydrogen-ion activity. W. J.

HAMER and S. F. ACREE (J. Res. Nat. Bur. Stand., 1939, **23**, 647—662).—Factors militating against the precise measurement of H-ion activity are discussed. The experimental procedures adopted with the cell $Pt|H_2|$solution + NaCl (KCl)$|AgCl_{(solid)}|Ag_{(solid)}$ for the potentiometric determination of the p_H of the solution are given. The e.m.f. of this cell is reproducible to 0·02 mv. (= 0·0003 p_H units) owing largely to the absence of a liquid junction. Data are recorded for solutions of malonates to illustrate the precision of measurement. W. R. A.

Oxidation-reduction potentials of methæmoglobin-hæmoglobin system.—See A., 1940, III, 296.

Polarisation capacity and adsorption properties of the silver electrode. V. I. VESELOVSKI (Acta Physicochim. U.R.S.S., 1939, **11**, 815—836).—The polarisation capacity of Ag has been determined from charging curves and by measuring the effect of adsorption of $Ag^{\cdot}$ on the potential; the vals. found by the two methods are respectively 640 and 620 µF. per sq. cm. over the potential range corresponding with the steady discharge of anions and the steady evolution of H_2. The capacity in the double layer region is 100—120 and 350—400 µF. per sq. cm. for a smooth and an etched electrode respectively. The zero charge of Ag is found at $E_h = 0{\cdot}046$ v., corresponding with $[Ag^{\cdot}] = 10^{-13}$N. The p.d. between a Ag and a Hg electrode, each at its zero charge potential, is 0·266 v., in agreement with the difference (0·25 v.) between the work functions of the two metals. The effects of the formation of an oxide film, which is present on Ag unless special precautions are observed, are discussed. F. L. U.

Adsorption and reduction of atmospheric oxygen at a dropping mercury electrode in presence of CN′ or S″ ions. J. P. GOCHSCHTEIN (J. Gen. Chem. Russ., 1939, **9**, 2055—2060).—The O_2 potential max. changes from positive to negative with rising [KCN] up to 0·0005N., thereafter rising to a much higher val. than in absence of CN′. It falls to zero as the $[Na_2S]$ is increased to 0·0005 N., above which it again rises, but in no case attains the vals. obtained in presence of CN′. R. T.

Limiting currents of some electrolytes. W. KEMULA (Atti X Congr. Internaz. Chim., 1938, II, 282—291).—The relationship between the limiting current (i) and the rate of fall of Hg at a dropping Hg cathode during the electrolysis of 0·1—0·0001N-KCl, -NaCl, -HCl, $-PbCl_2$, and $-BaCl_2$ solutions has been studied polarographically. From the relationship between i and concn. of electrolyte activity coeffs. are obtained. O. J. W.

Polarisation of electrolytic hydrogen evolution from nickel-iron and nickel-cobalt alloys in alkaline solution. G. GRUBE and U. CROATTO (Z. Elektrochem., 1939, **45**, 815—820; cf. A., 1939, I, 325).—C.d.-cathode potential (E) curves are given for Ni and the full range of Ni-Fe and Ni-Co alloys in 6N-KOH. The nature of the surface has a large effect; E for a polished Ni surface is ~0·25 v. > the val. for a surface rubbed with sand. E increases with time, a const. val. being reached more rapidly with a polished surface. The E-composition curves for Ni-Co alloys, with const. c.d., rise slowly with 0—70 wt.-% Co, and then more rapidly; the break is pronounced with high c.d., and the two segments correspond with the two types of mixed crystal obtained in these systems. The curves for Ni-Fe alloys correspond with those for O_2 evolution, and show irregularities, but no sharp breaks occur owing to abnormal crystallisation phenomena. A. J. E. W.

Polarographic analysis of mixtures of aldehydes and peroxides. V. STERN and S. POLAK (Acta Physicochim. U.R.S.S., 1939, **11**, 797—814).—Reduction potentials of org. peroxides at a dropping Hg cathode have been determined in aq. LiCl and in presence of CH_2O, MeCHO, and EtCHO. The vals. obtained are: MeO_2H and EtO_2H 0·25—0·3 v., $(OH{\cdot}CH_2)_2O_2$ 0·4 v., Et_2O_2 0·6 v., H_2O_2 0·8 v. When the peroxide concn. is ~0·0001% the error in its determination in presence of aldehydes is <8%. Since the aldehydes have reduction potentials >1·4 v. the method can be applied to the analysis of the products of incomplete combustion of hydrocarbons. CH_2O behaves erratically, the wave height being very sensitive to slight changes of temp., and the error with this substance may reach 30%. In all cases O_2 is eliminated from the solutions by bubbling H_2. AcO_2H is not reducible. F. L. U.

Oxidation-reduction potentials and their application. S. GLASSTONE (Trans. Electrochem. Soc., 1940, **77**, Preprint 14, 183—195).—A review.

Determination of solubility of sparingly soluble salts with the polarograph. T. A. KRIUKOVA (J. Phys. Chem. Russ., 1939, **13**, 693—700).—The experimental technique is described. The solubilities of Hg^{I} salts may be calc. from the anode potential in the anodic polarisation of the dropping electrode. R. C.

Potentiometric method of measuring coefficients of diffusion of electrolytes in aqueous solution. S. PLESNIEWICZ and W. MANDUK (Atti X Congr. Internaz. Chim., 1938, II, 441).—The diffusion of 0·1N-$AgNO_3$ in 1·0N-KNO_3 has been measured potentiometrically. O. J. W.

Ortho-para conversion of deuterium and the electric quadrupole moment of the deuteron. H. B. G. CASIMIR (Physica, 1940, **7**, 169—176).—Farkas and Sandler's results for the o-p conversion of D_2 in liquid H_2O (A., 1939, I, 149) can be explained by taking into account the interaction between inhomogeneous electric fields and the quadrupole moment of the deuteron, assumed to be of the order of magnitude found by Rabi. L. J. J.

Hydrogen isotope exchange reaction. J. O. HALFORD (J. Chem. Physics, 1940, **8**, 243—247).—Mathematical. Using the reactions of NH_3 and of CH_4 with D_2O, the possibility of deriving equilibrium consts. for higher D-substitution from the isotope exchange coeff. is examined. The second const. is determinable to within 10% of the correct val. if the solutions are in equilibrium with H_2O containing $\not>$25% D_2O and if the error in a single measurement is $\not>$1%. An equation relates the equilibrium const.

for the first substitution to the exchange factor at higher D-fractions, on the assumption that each successive D-substitution produces the same frequency shift. The evaluation of frequency shifts from exchange data is considered. W. R. A.

Exchange reaction of gaseous bromine and hydrogen bromide. L. C. LIBERATORE and E. O. WIIG (J. Chem. Physics, 1940, 8, 165—170).—Exchange between dry gaseous Br and HBr containing radioactive Br at total pressures up to ~150 mm. Hg and room temp. nearly reaches equilibrium in 2 min. The reaction is independent of surface and photochemical effects. The rate is ~10^{12} times that predicted by a simple cluster mechanism based on the ion pairs produced. A chain process involving Br atoms is suggested. L. J. J.

Kinetics and mechanism of decomposition of hydrocarbons. VII. Disturbing effect of unsaturated hydrocarbons on the decomposition of paraffin hydrocarbons. M. P. ESCHEVSKAJA (J. Gen. Chem. Russ., 1939, 9, 2162—2167).—The velocity of cracking of *n*- or *iso*-octane at 550° is unaffected by the presence of $(CH_2{:}CMe{\cdot}CH_2)_2$, $CH_2{:}CHEt$, or C_2H_4, but is lowered by addition of $CH_2{:}CMe_2$, $CH_2{:}CHMe$, $(CH_2{:}CH)_2$, *cyclo*hexene, or isoprene, to an extent ∝ concn., up to 10%; further rise in concn. of unsaturated hydrocarbon does not further depress the velocity. The composition of the reaction mixture is the same in presence or absence of unsaturated hydrocarbons. The effect is ascribed to binding of free radicals by the C:C group. R. T.

Rate of reaction of sodium atoms with polyhalogenated methane derivatives. J. N. HARESNAPE, J. M. STEVELS, and E. WARHURST (Trans. Faraday Soc., 1940, 36, 465—472; cf. A., 1937, I, 601).—The reaction of Na atoms with vapours of Cl- and/or Br-substituted CH_4 (except MeCl, CBr_4, CCl_2Br_2, and $CClBr_3$, but including $CHFBr_2$ and $CFBr_3$) diluted with H_2 or N_2 at ~250° was studied by the life period method and by the diffusion flame method. Decreasing collision yields (increasing reaction rates) are observed (*a*) when in similar compounds the halogen is changed from Cl through Br to I, (*b*) when the no. of atoms of the same halogen is increased, (*c*) when in a series of mixed halides each containing Br the no. of Cl atoms is increased, and (*d*) when in a bromide H is replaced by F, F by Cl, or Cl by Br. In all cases the decrease in collision yield corresponds with an increase in the at. refraction of the halogen atom concerned. It is probable that in all polyhalogenated CH_4 derivatives increase in at. refraction or in reaction rate runs parallel with decreasing force consts. for the particular C–halogen bonds. F. L. U.

Thermal polymerisation of gaseous styrene. H. MARK and J. W. BREITENBACH (Atti X Congr. Internaz. Chim., 1938, II, 335—338).—Gaseous styrene, at initial concns. of 4·71 to $23{\cdot}9\times10^{-3}$ mol. per l., polymerises between 220° and 311° to give products of low mol. wt. With increasing temp. the homogeneous dimerisation reaction becomes predominant. O. J. W.

Polymerisation of chloroprene. I. Influence of tetralin hydrogen peroxide on the kinetics of the polymerisation of chloroprene in the condensed phase. S. MEDVEDEV, E. TSCHILIKINA, and V. KLIMENKOV (Acta Physicochim. U.R.S.S., 1939, 11, 751—766).—The kinetics of the polymerisation of chloroprene (I) in the liquid phase under the influence of tetralin H peroxide (II) have been investigated, and details are given of the precautions and apparatus necessary for reproducibility. The results are interpreted in terms of two chain processes: linear polymerisation under the influence of (II), with $E = 10{\cdot}5$ kg.-cal., and side-polymerisation (chain-branching), which is independent of (II) and leads to the formation of insol. products, with $E = 20{\cdot}2$ kg.-cal., *i.e.* $= E$ for the thermal polymerisation. F. J. G.

Rate of dissociation of penta-arylethanes.—See A., 1940, II, 122.

Spontaneous ignition of hexane–air mixtures. S. JANTOVSKI, B. KRAVETZ, and A. SOKOLIK (Acta Physicochim. U.R.S.S., 1939, 11, 721—750).—The limits of spontaneous ignition of C_6H_{14}–air mixtures have been determined. The presence of residual gases, especially products of incomplete oxidation, from previous explosions, markedly favours auto-ignition, and this accounts for the discrepant results obtained by other workers. Traces of CO_2 have an inhibiting effect in the low-temp. region. The dependence of the time lag on the conditions has been studied. Accidental fluctuations are due chiefly to variations in the rate of filling the experimental vessel. F. J. G.

Combustion of aromatic and alicyclic hydrocarbons. III. Ignition and cool-flame characteristics. J. H. BURGOYNE, T. L. TANG, and D. M. NEWITT. **IV. Kinetics of the slow combustion of benzene and its monoalkyl derivatives at low temperatures.** J. H. BURGOYNE (Proc. Roy. Soc., 1940, A, 174, 379—393, 394—409; cf. A., 1939, I, 475).—III. An investigation was made of (i) the influence of initial pressure on the ignition ranges of mixtures of hydrocarbons with air and O_2, and (ii) the products of the reactions in the several combustion zones. Experiments were carried out at pressures up to 20 atm. C_6H_6, PhMe, and PhEt show smooth ignition curves whilst the other hydrocarbons examined exhibit low-temp. ignition systems. *cyclo*Hexane behaves as a typical paraffin; tetrahydrobenzene has cool-flame limits characteristic of the aromatic series.

IV. The combustion of C_6H_6, PhMe, PhEt, $PhPr^{a}$, and $PhBu^{a}$ was studied in the temp. range 250—400°. Except in the case of C_6H_6 the oxidation consists of two coexistent chain reactions, one of which predominates below 300° and the other above 400°. The kinetic characteristics of the two processes are compared. G. D. P.

Cool and hot flame of methyl ether. K. ERMAKOVA, A. ERMOLOVA, and M. NEUMANN (Acta Physicochim. U.R.S.S., 1939, 11, 679—700).—The rate of oxidation of Me_2O by O_2 at 320—400° and 40—90 mm. is $= kp^3e^{-8000/RT}$. At higher pressures the cool flame appears, and the *p–T* regions for the cool

and hot flames in Me_2O–O_2 and Me_2O-air mixtures have been determined. The cool flame region falls into four zones distinguished by differences of kinetic character. The dependence on p and T of the induction periods for the hot and cool flames, and the effect of additions of Et_2O_2, are described, and interpreted in terms of the peroxide theory of cool flame oxidation. F. J. G.

Kinetic methods of substitution, a method for determining particularly short-lived intermediate substances. H. SCHMID (Atti X Congr. Internaz. Chim., 1938, II, 484—492; cf. A., 1937, II, 188).—A further application of the author's method of studying rapid reactions. In the decomp. of NH_4NO_2 in solution the rate-determining reaction is $NH_4NO_2 + HNO_2 = N_2H^{\cdot} + NO_2' + 2H_2O$. The intermediate $N_2H^{\cdot}$, which can be regarded as the anion of NH:N·OH, decomposes rapidly into $N_2 + H^{\cdot}$. O. J. W.

Kinetics and mechanism of redox reactions. IV. Kinetics of the reaction of oxidation of the stannous ion with chlorate. V. F. STEFANOVSKI (J. Gen. Chem. Russ., 1939, 9, 1783—1795).—The velocity of oxidation of Sn^{II} in 1·5N-HCl at 20° is given by $-d[ClO_3']/dt = k[ClO_3'][Sn^{\cdot\cdot}]$, whilst in 4N-HCl at 30—40° it is given by $k_1[ClO_3'][Sn^{\cdot\cdot}] + k_2[ClO_3'][Cl']$. Under comparable conditions, the velocity of reduction of ClO_3' rises in the series $AsO_2' < Sn^{\cdot\cdot} < Fe^{\cdot\cdot} < Ti^{\cdot\cdot\cdot}$. R. T.

Energy and entropy of activation of the hydrolysis of ethyl orthoformate in deuterium oxide. F. BRESCIA and V. K. LAMER (J. Amer. Chem. Soc., 1940, 62, 612—614).—The rate of hydrolysis of $CH(OEt)_3$ has been measured at 14·977° and 35·008° in H_2O and D_2O. The observed difference in the calc. energies of activation predicts a nine-fold increase in the rate in passing from H_2O to D_2O, whereas the observed increase is three-fold. The entropy of activation is an important factor in the increased rate of hydrolysis in D_2O. W. R. A.

Electrostatic influence of substituents on reaction rates. I. F. H. WESTHEIMER and M. W. SHOOKHOFF (J. Amer. Chem. Soc., 1940, 62, 269—275).—The electrostatic theory has been applied to the problem of the effect of polar substituents on reaction velocities. The rates of alkaline hydrolysis of oxamide (I), Na oxamate (II), $Bu^{\gamma}OAc$ (III), $CH_2Cl·CO_2Bu^{\gamma}$ (IV), Bu^{γ} betainium chloride (V), and $NMe_2·CH_2·CO_2Bu^{\gamma}$ (VI) have been measured by the conductivity method. Using the equations developed by Kirkwood and Westheimer (A., 1938, I, 574) the ratio of the rates of the hydrolysis of (I) : (II), (III) : (IV), and (V) : (VI) is quantitatively in agreement with the hypothesis that the effect of a polar substituent on the velocity of these hydrolyses is primarily electrostatic in origin. W. R. A.

Rates of reaction of *p*-alkylbenzhydryl chlorides with ethyl alcohol. N. A. TAHER (J. Osmania Univ., 1938, 6, 28—32).—Determination of the velocity coeffs. of alcoholysis of *p*-alkylbenzhydryl chlorides show that the alkyl group reactivity decreases in the order $Me > Et > Pr^{\beta} > Bu^{\gamma}$. This agrees with Baker and Nathan's theory that the order of electron-release by alkyl groups is reversed when they are directly attached to an aromatic nucleus. p-iso*Propyl*-, b.p. 155°/0·3 mm., and p-iso*butyl*-, b.p. 154°/1 mm., -*benzhydryl chloride* are described. D. F. R.

Influence of solvent and temperature on speed of oxidation of organic substances by chromic acid. II. H. C. S. SNETHLAGE (Rec. trav. chim., 1940, 59, 111—130; cf. A., 1937, I, 570).—The velocity (v) of reaction between $H_2C_2O_4$ and CrO_3 was measured at 30° and 50° in aq. solutions containing 0—95·8% of H_2SO_4. The effect of the solvent depends on both $[H_2C_2O_4]$ and $[CrO_3]$, but for all concns. v decreases to a min. with increasing $[H_2SO_4]$ and attains a max. at ~70% of H_2SO_4. The reaction in 60—70% H_2SO_4 is nearly bimol., whilst in 13·4% H_2SO_4, and in its initial stages in H_2O, it is termol. The temp. coeff. for 20° varies from 4·32 (H_2O) to 8·8 (70% H_2SO_4). In solvents with <13% of H_2SO_4 oxidation is incomplete owing to compound formation between the reactants. F. L. U.

Saponification of nitriles. I. Alkaline saponification of some disubstituted acetonitriles. E. ANGELESCU, G. VASILIU, and S. RADVAN (Bull. Acad. Sci. Roumaine, 1939, 22, 220—229).—The rates of saponification of nitriles CHPhR·CN, where R = H, Me, Et, Pr^{α}, *cyclo*hexyl, and Ph, have been determined at 100° and 110·6° in presence of KOH in $C_5H_{11}·OH$ solution. The reactions are bimol. In the homologous series R = H to R = Pr, the velocity coeff. (k) diminishes with increasing mol. wt. (M) according to $kM^p = a$, p and a being consts., but this gives rates for R = *cyclo*hexyl and R = Ph which are too high and too low respectively. The consts. of the Arrhenius equation range from E = 12,700 g.-cal. (for R = Ph) to E = 18,700 g.-cal. (for R = Pr^{α}), and from log PZ = 15·23 (for R = Ph) to log PZ = 23·39 (for R = H). F. J. G.

Influence of alkyl groups on reaction velocities in solution. IV. Alkaline and acid hydrolyses of ethyl esters of lower saturated aliphatic acids in aqueous acetone. G. DAVIES and D. P. EVANS (J.C.S., 1940, 339—345; cf. A., 1938, I, 578).—Analysis of the results of kinetic study of the acid and alkaline hydrolysis of aliphatic esters in 70% $COMe_2$ on the basis of the equation $k = PZe^{E/RT}$ shows that the velocity varies mainly with changes in E in alkaline hydrolysis. The factor P increases with E for straight-chain esters. E is const. for straight-chain esters in acid hydrolysis, although the velocity decreases in ascending the series $R·CO_2Et$. Mechanisms for alkaline and acid hydrolysis of esters are discussed. F. H.

Exchange reaction of nuclear hydrogen of aniline hydrochloride in aqueous solution. II. Reaction in alkaline solution. M. KOIZUMI (Bull. Chem. Soc. Japan, 1940, 15, 8—15; cf. A., 1940, I, 166).—Measurement of the velocity coeff. in dil. KOH indicates that in addition to the reaction $NH_2Ph + H_2DO^{\cdot} \rightarrow C_6H_4D·NH_2 + H_3O^{\cdot}$ the reaction $NH_2Ph + NH_2PhD^{\cdot} \rightarrow C_6H_4D·NH_2 + NH_3Ph^{\cdot}$ also occurs. In acid solution the formation of a loose compound $NH_2Ph–H_3O^{\cdot}$ is postulated. D. F. R.

Alkaline saponification of polyvinyl acetate. A. SKRABAL (Z. physikal. Chem., 1939, **185**, 389—392).—The work of Lee and Sakurada (A, 1939, I, 476) having been carried out in MeOH–H_2O solution, it is possible that a rapid ester exchange had occurred affording MeOAc and polyvinyl alcohol, and that the saponification of the former was actually the measured reaction. F. J. G.

Alkaline hydrolysis of acetylated dipeptides. A. P. KONIKOV and C. N. LERMAN (J. Gen. Chem. Russ., 1939, **9**, 2115—2120).—The rate of hydrolysis by aq. NaOH of both ·CO·NH· groups of acetylated dipeptides falls in the order AcR·R·OH > AcR·R′·OH > AcR′·R·OH > AcR′·R′·OH (R = ·NH·CH_2·CO·, R′ = ·NH·CHMe·CO·). This inhibiting effect of the α-Me group is ascribed to limitation of the possibility of tautomeric transformation of the ⁚CH·CO·NH· groups. R. T.

Reaction between ascorbic acid and mercuric chloride in heavy water. R. INDOVINA and B. SALEMI (Annali Chim. Appl., 1940, **30**, 62—65).—The conductometric method indicates that the velocity of reaction between aq. ascorbic acid and $HgCl_2$ is diminished by addition of D_2O. F. O. H.

Kinetics of phase change. II. Transformation–time relations for random distribution of nuclei. M. AVRAMI (J. Chem. Physics, 1940, **8**, 212—224; cf. A., 1940, I, 122).—The general theory is simplified in the case where the grain centres of the new phase are randomly distributed, and the kinetics of the main types of cryst. growth are studied. L. J. J.

Particular type of heterogeneous reaction. G. TEDESCHI (Atti X Congr. Internaz. Chim., 1938, II, 536—545).—The velocity of the heterogeneous process, in which a solid dissolves in a liquid and then reacts chemically in the solution, is calc. theoretically. O. J. W.

Absolute rates of heterogeneous reactions. II. Electrode reactions. G. E. KIMBALL (J. Chem. Physics, 1940, **8**, 199—204; cf. A., 1938, I, 522).—The theory of the previous paper is extended to include reactions at electrode surfaces. Activation and diffusion are controlling factors; the latter is concerned in the effect of stirring rate. Dissolution of metals in acids involves a very complex rate-determining mechanism, in which the concn. of every ion present is involved. L. J. J.

Heterogeneous ortho–para conversion on paramagnetic crystals. L. FARKAS and L. SANDLER (J. Chem. Physics, 1940, **8**, 248—251).—The rate of conversion of p-H_2 and o-D_2 has been measured on some paramagnetic crystals ($CuSO_4$, $NiCl_2$, Nd oxalate). The rate is max. at 0°, and at <0° the desorption rate of the H_2 and D_2 is the rate-determining factor. The rate of desorption increases with increasing temp., and at high temp. the rate of surface conversion is slow. The heat of adsorption of H_2 on Nd oxalate is ~2·4 kg.-cal. per mol. W. R. A.

Law of linear crystal growth on the basis of observations on non-metallic materials. Application to metals. G. MASING and R. REINBACH (Atti X Congr. Internaz. Chim., 1938, III, 594—603).—In well-stirred and slightly supercooled salol crystal growth occurs almost isothermally and so permits true measurements of the velocity of crystallisation (v). v increases with decrease of temp. the more rapidly the greater is the degree of supercooling. The results are discussed with reference to the observations of other workers and to possible application to metallic melts. J. W. S.

Surface conditions of silver halides and rate of reaction. I. Rate of reduction of precipitated silver chloride. T. H. JAMES (J. Amer. Chem. Soc., 1940, **62**, 536—540).—The reduction of pptd. AgCl by NH_2OH has been studied with special reference to the effects of ageing of the ppt., dye adsorption, gelatin adsorption, and [Cl′] on the initial reaction rate, r. The importance of surface conditions is clearly demonstrated by the close correlation between the sp. surface and r, both in ageing experiments and in the effect of an irreversibly adsorbed dye (9-methyl-3 : 3′-diethylthiocarbocyanine chloride), in which r is approx. ∝ the free surface. Gelatin markedly inhibits the reaction and a min. val. of r is obtained. Gum arabic has less effect than gelatin, and a min. val. of r is not found. The kinetics suggest that the initial reaction involves unprotected $Ag^{\cdot}$ ions at the AgCl surface. The effect of excess Cl′ ions on r ($r \propto 1/$[excess Cl′ ions]) suggests that when the AgCl surface is largely covered with Cl′ ions, further adsorption follows the Langmuir isotherm. W. R. A.

Velocity of dissolution of antimony, silver, and cadmium in the region of their "transition points." J. A. HEDVALL [with N. BOSTRÖM, B. COLLIANDER, and Å. HAMMARSON] (Z. anorg. Chem., 1940, **243**, 231—236; cf. A., 1933, 574).—Discontinuities in rate of dissolution corresponding with the supposed transition points of Sb at 101°, Ag at ~118°, and Cd at ~67° (A., 1915, ii, 471, 821) have been sought. Sb has a max. rate of dissolution at 101°, Cd shows no irregularity, whilst untempered specimens of Ag show increased irregularities of rate, but no max., at 115—118°. F. J. G.

Surface oxidation of metals in air. T. N. KRILOVA (Bull. Acad. Sci. U.R.S.S., 1938, Cl. Sci. Tech., No. 10, 89—112).—The rate of oxidation in air, at 20—550°, of a no. of metals has been studied by means of optical determinations of the thickness (L) of the oxide film. In all cases the rate of oxidation is given by $L^2 = Kt + C$ where K depends exponentially on temp. The order of increasing stability is Cu, Cd, Fe, Ni, Mg, Be, Cr, Al. Diffusion in the oxide film is the controlling factor. F. J. G.

Thermochemical studies of the velocity of corrosion of iron and of steel. W. SOLODKOWSKA (Atti X Congr. Internaz. Chim., 1938, II, 506—513).—The corrosion of Fe and steel in solutions of KCl and $CaCl_2$ can be conveniently followed by a micro-calorimetric method which is described. O. J. W.

Velocity of dissolution and corrosion of metals. M. CENTNERSZWER (Atti X Congr. Internaz. Chim., 1938, III, 555—565).—The author's views on the

mechanism of the dissolution and corrosion of metals in acids or alkalis (A., 1937, I, 417) are discussed and illustrated by results obtained with Mg, Al, Zn, Cr, Cd, Tl, Sn, and Cu. J. W. S.

Kinetics of partial transformation of austenite. —See B., 1940, 281.

(A) **Thermal decomposition of nitrogen iodide.** (B) **Heat of formation of nitrogen iodide.** F. R. MELDRUM (Proc. Roy. Soc., 1940, **A**, **174**, 410—424, 425—432).—(A) Analysis of the products of reaction at $-13°$ shows that the thermal decomp. is $2NH_3,NI_3 = 2NH_3 + N_2 + 3I_2$. NH_3 and H_2O vapour exert a retarding influence on the reaction, the rate of which also depends on the pressure of N_2 present. The mechanism of the reaction is discussed.

(B) From measurements of the heat of reaction of $2NH_3,NI_3$ with excess of aq. HI the heat of formation of the former from the elements is shown to be -35 kg.-cal. per mol. G. D. P.

Dehydration of crystals of chrome alum. J. A. COOPER and W. E. GARNER (Proc. Roy. Soc., 1940, **A**, **174**, 487—503).—The rate of growth of dehydration nuclei on (111) faces of a single crystal was measured at a variety of temp. Two different types of nuclei are recognised. The rate of decomp. was also measured by a loss of wt. method and it was found that the reaction stopped when $\sim$12 of the 24 mols. of H_2O of hydration had been lost. The mechanism of dehydration is discussed and the heat of dissociation and activation energy of the dehydration are deduced. The abnormally high val. of the latter is explained. Small pressures of H_2O vapour were found to produce an accelerated rate of dehydration. G. D. P.

Rate of formation of ammonium cinnamate. (MME.) D. MARKOWSKA (Compt. rend., 1940, **210**, 291—293; cf. A., 1940, I, 122).—The reaction between NH_3 at const. pressure p and solid cinnamic acid (I) (mean particle diameter e_0) follows the equation $kt/e_0^2 = 7{\cdot}289 - (1 - m)^{\frac{2}{3}} - 6{\cdot}289(1 + 0{\cdot}159m)^{\frac{2}{3}}$, where m is the fraction of the (I) which has reacted at time t. The rate of reaction is const. at 5·6—25°, reaches a max. at 30°, and falls with further temp. rise. The const. $k \propto p^{1{\cdot}4}$. A. J. E. W.

Polarographic method in organic chemistry. II. Correction for losses of volatile substances removed by the flow of inert gases through the electrolyte. V. GNIUBKIN, A. DOBRINSKAJA, and M. NEUMANN (Acta Physicochim. U.R.S.S., 1939, **11**, 701—720).—The rate of removal of volatile substances (*e.g.*, Et_2O_2, aldehydes) from electrolyte solutions by a stream of H_2 is calc., using Raoult's law with a factor α to take account of non-ideality, and compared with experimental results. The vals. so obtained for α agree with those obtained by other methods. Applications to the polarographic analysis of org. mixtures are discussed. F. J. G.

Resonance theory of auto-catalysis. D. A. FRANK-KAMENETZKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 669—670).—A lowering of activation energy through resonance between two canonical structures of the transition state, arising when reaction takes place in a collision of a molecule of product with a mol. in the initial state, is suggested in the case of reactions of the form $A \rightarrow B_x \rightarrow B$ where A and B are initial and final states, and B_x is the transition state. L. J. J.

Periodic processes in kinetics of oxidation reactions. D. A. FRANK-KAMENETZKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 671—672).—The kinetics of an autocatalytic reaction involving the participation of two active intermediate products X and Y, formed autocatalytically from the initial substance A and from X, respectively, of the form $A + X \rightarrow B + 2X$; $X + Y \rightarrow B + 2Y$; $A + Y \rightarrow B$, are considered. A periodic process results, in which the concns. of X and Y alternately increase and decrease with time between mutually dependent crit. vals. The existence of such a process is suggested in two-stage ignition and vibrational cool-flame phenomena in the oxidation of higher hydrocarbons. L. J. J.

Iodine-sensitised decomposition of methyl alcohol. G. K. ROLLEFSON and W. GARRISON (J. Amer. Chem. Soc., 1940, **62**, 588—590).—At 325° the over-all I-sensitised decomp. of MeOH can be represented: $3MeOH = 2CH_4 + CO + 2H_2O$, resulting from $MeOH + 2I_2 = CO + 4HI$, $MeOH + 2HI = CH_4 + I_2 + H_2O$. The preponderance of CO in the early stages of the reaction is caused by the greater speed of the first reaction. W. R. A.

Inhibition of the hydrogenation of ethylene by nitric oxide. H. D. BURNHAM and R. N. PEASE (J. Amer. Chem. Soc., 1940, **62**, 453).—The hydrogenation of C_2H_4 to C_2H_6 is inhibited by NO (cf. Stavely, A., 1938, I, 87). The effect of NO tends to zero at $>$20% reaction as for the dissociation of n-C_4H_{10} (cf. Echols and Pease, A., 1939, I, 376). NO is more effective at higher temp. W. R. A.

Inhibition of ethylene polymerisation by nitric oxide. H. D. BURNHAM and R. N. PEASE (J. Amer. Chem. Soc., 1940, **62**, 453—454).—The polymerisation of C_2H_4 is inhibited by NO. As in the hydrogenation of C_2H_4 and the dissociation of n-C_4H_{10} (cf. preceding abstract) the effect of NO vanishes slowly as the reaction proceeds. The reaction is probably of the radical chain type. W. R. A.

Catalytic decomposition of azodicarbonate ion. C. V. KING (J. Amer. Chem. Soc., 1940, **62**, 379—385).—The decomp. of the azodicarbonate ion $(:N{\cdot}CO_2)_2''$ to give N_2, N_2H_4, and CO_2 or the CO_3'' ion is sensitive to general acid catalysis, being catalysed by H_2O, $H^{\cdot}$ ions and other acids according to $dx/dt = C_{N_2(CO_2)_2''}(k_1C_{H_3O^{\cdot}} + k_2C_{H_2O} + k_3C_{HA} \ldots)$. This equation does not explain completely the mechanism since mol. catalysis by sucrose is diminished by bases. The evaluated mol. catalytic consts. show good agreement with the Brönsted equation $k_m/p = G(q/pK_A^0)^x$ where $G = 7{\cdot}40 \times 10^8$ and $x = 0{\cdot}86$. W. R. A.

Retardation of chemical reactions. X. Choice of retarders in liquid-phase oxidations. K. C. BAILEY (Proc. Roy. Irish Acad., 1939, **45**, **B**, 373—412).—Tables are given summarising published data on the efficacy or otherwise of a large no. of

org. and inorg. substances in retarding the oxidation of a large no. of org. liquids and inorg. solutions.
F. J. G.

Conversion of γ-fructose into normal fructose.—See A., 1940, II, 119.

Catalytic oxidation action of ozone. E. BRINER (Atti X Congr. Internaz. Chim., 1938, II, 175).—A brief summary. O. J. W.

Catalytic isotopic exchange of gaseous oxygen. V. Sorption of oxygen by manganese oxide and exchange reaction of oxygen atoms between oxygen gas and manganese oxide. 2. Experimental and discussion. N. MORITA (Bull. Chem. Soc. Japan, 1940, **15**, 1—8; cf. A., 1939, I, 207).—The exchange of ^{18}O between O_2 and Mn_2O_3 becomes appreciable above 300° and amounts to 4—9% at 400°. The exchange of O between H_2O and O_2 in contact with Mn_2O_3 follows the reactions: $Mn_2O_3 + 0{\cdot}5O_2 = 2MnO_2$; $2MnO_2 + H_2O = Mn_2O_3,H_2O_2$; $Mn_2O_3,H_2O_2 = Mn_2O_3 + H_2O + 0{\cdot}5O_2$.
D. F. R.

Combustion of carbon monoxide on hopcalite and its components. G. M. SCHWAB and G. DRIKOS (Z. physikal. Chem., 1940, **185**, 405—425).—Reduction of CuO by CO begins at 100—140°, reoxidation by O_2 at room temp. For MnO_2 the corresponding temp. are 30—40° and 80—100°, so that with the former reduction, and with the latter reoxidation, is the slower, rate-determining step. With hopcalite (I) reduction begins at temp. > for MnO_2 but < for CuO, and reoxidation begins at room temp. CuO, MnO_2, and (I) are reduced by all mixtures containing excess of CO and reoxidised by all mixtures containing excess of O_2. The rate of combustion in presence of excess of O_2 is independent of the degree of oxidation of the catalysts, but $\propto$ [CO]. With mixtures containing excess of CO the rate of combustion on CuO and MnO_2 decreases as the catalyst becomes reduced, but on (I) it decreases only slightly to a limiting val. which $\propto [O_2]$. The temp. coeffs. are very low. The reactions are rapid and quant. on the surface, the observed rates being controlled by diffusion. F. J. G.

Catalytic toxicity and chemical structure. V. Simple anions containing toxic elements. E. B. MAXTED and R. W. D. MORRISH (J.C.S., 1940, 252—256; cf. A., 1938, I, 316, 406).—The catalytically toxic character of S, Se, and Te is lost in their compounds only if the normally poisonous atom is present in a mol. such that this atom is shielded by a completely shared electron octet as shown by the absence of toxic effects towards Pt-black in SO_4'', sulphonate, SeO_4'', and TeO_4'' and the reduction of the activity of the catalyst in the presence of S'', S_2O_3'', S_4O_6'', SeO_3'', and TeO_3''. Poisoning does not occur with PO_4''' due to the shielding effect but does occur with HPO_3'' and with H_2PO_2' although in the structures usually assigned to these ions P is shielded by a completely shared electron octet. The apparent anomaly is probably due to weakness of the P–H bond, covalently linked H failing to protect the Pt catalyst from linkage with P. F. H.

Corrosion of iron in water. Influence of small concentrations of sodium silicate.—See B., 1940, 330.

Contact sulphuric acid manufacture.—See B., 1940, 274.

Isomerisation of unsaturated hydrocarbons in contact with oxides of metals. III. Comparison of the activity of certain catalysts in the isomerisation of allylbenzene. R. J. LEVINA (J. Gen. Chem. Russ., 1939, **9**, 2287—2290).—The catalytic activity of a no. of substances in the reaction $CH_2Ph{\cdot}CH{:}CH_2 \rightarrow CHPh{:}CHMe$, at 220°, is expressed by Al_2O_3 100, Cr_2O_3 93, Fe_2O_3 72, clay 26, SiO_2 gel, active C, and Ni–asbestos 5, glass 0; at 300° the vals. are Pd–asbestos 90, Cr_2O_3 86, Ni–Al_2O_3 80, Fe_2O_3 and SiO_2 gel 58, active C 38—42, clay 35, Ni–asbestos 11, glass 0. R. T.

Influence of the nature of the substituent on the velocity of catalytic hydrogenation of certain trisubstituted ethylenes in presence of palladium-black. B. A. KAZANSKI and G. T. TATEVOSJAN (J. Gen. Chem. Russ., 1939, **9**, 2256—2262).—The velocity of hydrogenation of substituted ethylenes rises in the order $CHMe{:}CEt_2$ (I) < $CHPh{:}CPh_2$ < $CHPh{:}CMe_2$ < $CPh_2{:}CHMe$. In mixtures of these hydrocarbons those containing Ph are hydrogenated before (I). The velocity of hydrogenation of (I) is lowered in presence of $PhBu^{\beta}$, $CHPh_2Et$, or $CHPh_2{\cdot}CH_2Ph$, and of Δ^{δ}-nonene in presence of C_6H_6.
R. T.

Influence of the p_H on the velocity of hydrogenation of *cyclo*hexene and of acetone in presence of Raney nickel. B. FORESTI [with F. POZZI] (Atti X Congr. Internaz. Chim., 1938, II, 235—242; cf. A., 1937, I, 571).—The influence of p_H on the velocity of hydrogenation in presence of Raney Ni is similar to that found earlier in the presence of Pt-black, and confirms the author's views on the influence of p_H on the activity of the catalyst. O. J. W.

Thermal formation of the cyanides of the elements of the iron group and the catalysis of the cyanide–cyanamide equilibrium. A. PERRET (Atti X Congr. Internaz. Chim., 1938, II, 743—749; cf. A., 1938, I, 93).—The quantities of $MnCN_2$ produced by heating $MnCl_2 + 2NaCN$ at 380—650° with and without the presence of reduced Fe catalyst have also been determined. O. J. W.

Conversion of *para*-hydrogen by porphyrin compounds, including hæmoglobin. D. D. ELEY (Trans. Faraday Soc., 1940, **36**, 500—505).—The influence of hæmatoporphyrin, hæmatin, hæmin, and H- and Cu-phthalocyanine as heterogeneous catalysts on the conversion of *para*-H was examined and the results are tabulated. At and below room temp. the conversion is catalysed by all the paramagnetic solids but not by the diamagnetic ones. In solution, hæmatin, hæmin, and hæmoglobin are catalysts, the last being specially effective. F. L. U.

High-pressure [catalytic] hydrogenation of benzene.—See B., 1940, 264.

Catalytic dehydrogenation of gaseous paraffins.—See B., 1940, 260.

Synthesis of acetates of higher alcohols by their catalytic dehydration.—See B., 1940, 264.

Experimental evidence for the secondary deposition of metals on the cathode in the electrolysis of complex salts. A. GLAZUNOV, O. STAROSTA, and V. VONDRÁŠEK (Z. physikal. Chem., 1939, **185**, 393—399).—The view, that in the electrolysis of a complex salt the primary process is the discharge of a complex cation (*e.g.*, Ag_2CN^+) to form an unstable at. grouping (*e.g.*, Ag_2CN), which subsequently breaks up, is supported by the observation that in the electrodeposition of Cu from a CN′ bath glass fibres stretched over the cathode become coated with Cu. F. J. G.

Electrolytic oxidation. XII. Mechanism of electrolytic formation of periodates. A. HICKLING and S. H. RICHARDS (J.C.S., 1940, 256—264; cf. A., 1939, I, 480).—The oxidation of IO_3' to IO_4' occurs with moderate efficiency at PbO_2 or Ni anodes, and with less efficiency at platinised or smooth Pt anodes, but does not occur at MnO_2 or C anodes. The efficiency is least in acid and greatest in alkaline solutions, increasing with factors favouring formation of higher oxides on the electrode, *e.g.*, prepolarisation, with Pt and PbO_2, and with increase in temp. except in the case of a smooth Pt anode in alkaline solution. The anode potentials set up during the process appear to be due merely to O_2 evolution, no definite oxidation–reduction potential being found. The most probable mechanism is oxidation of IO_3' by metallic peroxides formed on the electrode surface, and to a smaller extent by H_2O_2 formed initially on discharge of OH. F. H.

Chemical action of electric discharges. XIX. Production of ozone by the high- and low-frequency electric arcs. E. BRINER, J. DESBAILLETS, and H. HÖFER (Helv. Chim. Acta, 1940, **23**, 323—328).—O_3 is formed in small amounts by the action of the electric arc on O_2. The yield is improved by the use of a high-frequency arc and a rapid flow of gas at low pressure. F. J. G.

Photochemical oxidation of hydrogen. H. A. SMITH and A. NAPRAVNIK (J. Amer. Chem. Soc., 1940, **62**, 385—393).—By exposing mixtures of H_2 and O_2 at room temp. to light (1719—1725 A.) the photochemical oxidation of H_2 has been investigated at from 95 to 1140 mm. total pressure. With increasing $[O_2]$ the quantum yield of O_3 increases whilst that of H_2O_2 and H_2O decrease. Lowering the total pressure increases the H_2O_2 and H_2O yields at the expense of the O_3. At total pressures $\ngtr$190 mm. the formation of H_2O shows chain characteristics. From 25° to 280° the formation of O_3 has a negative temp. coeff. whilst those of H_2O and H_2O_2 formation are positive. At a total pressure of 190 mm. for a 10—90% O_2–H_2 mixture the temp. coeff. of H_2O and H_2O_2 formation increase rapidly at temp. >230°. A suggested mechanism explains satisfactorily the experimental data. The relation between the photochemical reaction and the Hg-sensitised and explosive reactions is discussed. W. R. A.

Photochemistry of antimony oxide. G. COHN and C. F. GOODEVE (Trans. Faraday Soc., 1940, **36**, 433—440).—All forms of Sb_2O_3 can be darkened by ultra-violet light if H_2O or certain reducing agents are present. The photo-reaction may be internal, consisting in the formation of Sb and O, the latter being retained in a neighbouring position; this reaction requires the presence of H_2O, and is reversed when the H_2O is removed by heating. The external photochemical reduction of Sb_2O_3 is highly sp.; N_2H_4, NH_2OH, and aq. KI form Sb irreversibly, with glycerol the action can be reversed if O_2 together with a liquid miscible with glycerol is taken up, whilst CH_2O, BuOH, $C_5H_{11}\cdot OH$, and linseed oil are inactive. The orthorhombic form of Sb_2O_3 can form an internal photo-active system by the "building-in" of H_2O. F. L. U.

Transfer of excitation energy from uranium ions in solution. A. H. CARTER and J. WEISS (Proc. Roy. Soc., 1940, **A**, **174**, 351—370).—The photosensitised decomp. of $H_2C_2O_4$ by U ions was investigated and information about the mechanism of the energy transfer was obtained by study of the reaction in the presence of I′ and Br′ which act as quenchers of the U fluorescence. Wide differences in the amounts of the products of decomp., CO, CO_2, and HCO_2H, with differing concn. of quenching substance were observed. A theory based on the electron transfer process between excited U ions and C_2O_4'' ions is advanced. G. D. P.

Action of ordinary metals on the photographic plate. J. A. REBOUL (J. Phys. Radium, 1940, [viii], **1**, 56—62).—A detailed account of work already noted (cf. A., 1939, I, 297). W. R. A.

Polymerisation of ethylene by alkyl radicals. J. C. JUNGERS and L. M. YEDDANAPALLI (Trans. Faraday Soc., 1940, **36**, 483—493; cf. A., 1938, I, 261).—Reaction of C_2H_4 with free radicals produced by the photodecomp. of their iodides in presence of Hg was studied by measuring the corresponding pressure changes. The yield for a given radical increases with increasing $[C_2H_4]$, and with decreasing [RI] and light intensity. The yield for different radicals decreases in the order Me > Et > Pr^a > Pr^β. The polymerides are formed by bimol. addition of C_2H_4 mols. to the radicals, the differences being due to the influence of the steric factor on the primary process RI $\rightleftharpoons$ R + I. The disappearance of radicals during the reaction is due (*a*) to saturation through capture of H atoms at low [R], and (*b*) to bimol. recombination at high [R]. F. L. U.

Splitting the CO·NH linkage by means of ultra-violet light. D. C. CARPENTER (J. Amer. Chem. Soc., 1940, **62**, 289—291).—A detailed account of work already noted (cf. A., 1939, I, 426). W. R. A.

Relative efficiency of active wave-lengths of ultra-violet in activation of 7-dehydrocholesterol. J. W. M. BUNKER, R. S. HARRIS, and L. M. MOSHER (J. Amer. Chem. Soc., 1940, **62**, 508—511).—The photochemical activation of cryst. 7-dehydrocholesterol (I) in Et_2O by monochromatic ultra-violet light (2483, 2537, 2652, 2804, 3025 A.) is approx. uniform per $h\nu$ of energy applied. Activation by 2967 A. is > by the other λλ; that by 2894 A. is intermediate between that by 2967 A. and the others. No antirachitic properties were produced by irradiation of (I) with 3130 A. The greater efficiency of 2967 A. in antirachitic activation of (I) is parallel to the

superiority of this in inducing healing on direct irradiation of depilated rachitic rats. This supports the hypothesis that (I) is a precursor of vitamin-*D* in the skin. W. R. A.

Asymmetric catalysis. Absolute asymmetric synthesis. M. BETTI and E. LUCCHI (Atti X Congr. Internaz. Chim., 1938, II, 112—116).—By the action of circularly polarised light on the gaseous system CH_2:CHMe + X_2 (X = Cl or Br) optically active CH_2X·CHXMe is obtained. The direction of rotation is in the same sense as that of the polarised light and the observed rotations amounted to ±0·04—0·05° in a 10-cm. tube. O. J. W.

Photochemical reactions in the *o*-nitrobenzylideneacetal series. XIII—XV.—See A., 1940, II, 154.

Influence of monochromatic light on enzyme action. XXVI—XXXIII.—See A., 1940, III, 342.

Resolving power of photographic film for electronic radiation. M. VON ARDENNE (Z. Physik, 1939, **114**, 379—388).—The resolving powers of photographic plates, films, and papers towards electron rays have been measured using a special micro-technique, by observing the distribution of blackening on and in the sensitive layer. L. G. G.

Chemical action of γ-radiation from ^{80}Br. F. FAIRBROTHER (Nature, 1940, **145**, 307).—Experiments on the exchange of radio-Br between org. and inorg. bromides show that some of the latter, *e.g.*, $AlBr_3$, and a wide range of the former exchange all Br atoms in the system very quickly at room temp. Many other inorg. bromides, *e.g.*, $SbBr_3$, $AsBr_3$, and PBr_3, show no exchange but extract the 18-min. ^{80}Br isotope from the radioactive org. bromide (EtBr); the 4·5- and 36-hr. isotopes remain with the org. bromide. Crystals of $HgBr_2$ and of KBr, and metallic Ag, Hg, and Au show a less complete extraction. Since the energy of mechanical recoil from the γ-ray emitted during the isomeric transition of ^{80}Br, or from its conversion electrons, is not large enough to break the C–Br linking or to effect the observed reactions, these are attributed to a fission of the linking by intramol. photo-dissociation. L. S. T.

Rôle of electrons in certain physico-chemical phenomena. II. Attack of metals by acids. N. V. KARPEN (Bull. Acad. Sci. Roumaine, 1939, **22**, 193—195).—Theoretical. The phenomena are discussed in terms of equilibrium between cations and electrons in the metal and in solution. F. J. G.

Attack of metals. V. KARPEN (Compt. rend., 1940, **210**, 371—374).—A further development of the electron-concn. principle (cf. A., 1940, I, 75). Dissolution is due to absence of statistical equilibrium between cations and electrons in the metal and in the attacking medium. The theory explains the greater ease of attack by acids of metals of low ionisation energy, and the slow attack of pure metals. A. J. E. W.

Replacement of iron by aluminium in the preparation of potassium iodide by double decomposition. P. G. PATERNOSTO (Rev. Fac. Cienc. Quím. La Plata, 1939, **14**, 31—35).—The yield of KI from 0·8M-Al_2I_6 and M-K_2CO_3 is 98·5—99% of the I used. Al_2I_6 is preferred to Fe_3I_8 owing to its high I : metal ratio. F. R. G.

Chemical reactions between substances sparingly volatile in a high vacuum. R. DUBRISAY (Atti X Congr. Internaz. Chim., 1938, II, 624—631).—The blackening of Ag, Cu, or Hg by S in a high vac. (cf. A., 1935, 1212) is due to S vapour and not to any trace of S compounds. The more rapid blackening in a very high vac. is due partly to the increased rates of sublimation of S and of diffusion of its vapour, and partly to the removal of adsorbed gas films. O. J. W.

Complex cuprothiocyanate. L. M. KULBERG and A. K. GORLINSKI (J. Gen. Chem. Russ., 1939, **9**, 1707—1709).—A blood-red coloration develops when KCNS is added to a solution of $Cu(CNS)_2$ in $COMe_2$; max. absorption is at λ = 530 mμ. The complex is probably $K_2[Cu(CNS)_4]$ or $K[Cu(CNS)_3]$. R. T.

Preparation of large single crystals of metals. M. SMIAŁOWSKI (Wiadom. Inst. Met., 1936, **3**, 184—188; Chem. Zentr., 1937, i, 3603).—Methods for metals of high and low m.p. are described. Cu, Pb, and Sn readily form single crystals, but Zn, Al, Bi, and Sb do so less readily. After etching with conc. HNO_3 and HCl, spherical Zn crystals reflect from the $\{10\bar{1}0\}$, $\{10\bar{1}1\}$, and $\{0001\}$ planes; cylindrical crystals give 6 ($\{10\bar{1}0\}$) or 4 reflexions ($\{10\bar{1}0\}$ and $\{0001\}$), according to the orientation of the hexagonal axis to the axis of the cylinder. A. J. E. W.

Methods of preparation of metallic single crystals. L. GUILLET (Chim. et Ind., 1940, **43**, 283—286).—A review. F. J. G.

Interaction of gold with telluric and selenic acids. O. E. ZVJAGINTZEV and E. A. JAKOVLEVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 400—401).—Au is insol. in H_2SeO_4 and H_2TeO_4. Compounds of Au and H_2TeO_4 can be obtained by the action of the acid on $Au(OH)_3$, but have not been isolated in the pure state. A. J. M.

Synthesis of dolomite by double decomposition. F. HALLA (Zentr. Min., **A**, 1937, 9—12; Chem. Zentr., 1937, i, 3934),—Dolomite is undoubtedly a double salt, but attempts at synthesis by double decomp. have failed. A. J. E. W.

Calcium thio-, chloro-, and nitro-ferrites. G. MALQUORI and E. CARUSO (Atti X Congr. Internaz. Chim., 1938, II, 713—718).—The prep. of $3CaO,Fe_2O_3,CaSO_4$,aq., $3CaO,Fe_2O_3,CaCl_2$,aq., and $3CaO,Fe_2O_3,Ca(NO_3)_2$,aq. and their behaviour with regard to incongruent solubility are described. The compounds are analogous to those in which Fe is replaced by Al. O. J. W.

Hydrated monocalcium silicate. V. CIRILLI (Atti X Congr. Internaz. Chim., 1938, II, 612).—Calorimetric and dehydration experiments show that this hydrate contains 1 mol. of H_2O of constitution. Dehydration commences above 130° and is complete at ~700°, with the formation of Ca_2 silicate and SiO_2, which recombine at high temp. to give wollastonite. O. J. W.

Hydrated calcium silicates. J. FORET (Atti X Congr. Internaz. Chim., 1938, II, 638—644).—*X*-Ray investigations show that the product obtained by heating $CaO + SiO_2 + H_2O$ under pressure up to 130° is identical with the Ca silicate obtained by pptn. at room temp. Above 140° a β-form, capable of absorbing CaO, is formed. The degree of hydration of these silicates decreases with increase in temp. of formation. O. J. W.

Purification of mercury. A. DOBROWSKY (Chem.-Ztg., 1940, **64**, 32).—The purification of Hg by shaking with aq. $KMnO_4$ is most effective for highly impure specimens. E. M. W.

Dissolution of mercuric sulphide in acid solutions of potassium iodide. A. A. VASSILIEV and N. P. VOROBEVA (J. Gen. Chem. Russ., 1939, **9**, 1764—1765).—HgS dissolves in conc. solutions of KI in dil. HCl, with evolution of H_2S, and formation of HgI_4''. R. T.

Preparation, and qualitative and quantitative analysis of dithiobasic mercury dichromate. G. L. CHABORSKI and T. TRIFĂNESCU (Bul. Chim. Soc. Române, 1938, **39**, 65—69).—Freshly-pptd. HgS, heated (water-bath) for 10—12 hr. with 4 times its wt. of CrO_3, and 50 c.c. of H_2O for each 100 g. of the mixed solids, gives an orange *powder*, which after washing with H_2O, EtOH, and Et_2O has the formula $Hg_3S_2Cr_2O_7$, probably $[Hg(HgS)_2]Cr_2O_7$ (I). Some properties are recorded. The *X*-ray data given show that (I) is a single substance, and not an adsorption compound of HgS and CrO_3. L. S. T.

Preparation, properties, and analysis of thiobasic mercury sulphate. G. L. CHABORSKI and E. POTAMIAN (Bul. Chim. Soc. Române, 1938, **39**, 27—33).—HgS, pptd. from $HgCl_2$ by H_2S and dried at 105°, is mixed with equal parts of perhydrol and conc. H_2SO_4, and eventually warmed until the product of the reaction is white. After pouring into H_2O, filtering, washing with H_2O and finally with EtOH, and drying at 105°, the *product* is $Hg(HgS)SO_4$ (I). The *X*-ray diagram is that of a single substance and not of a mixture of $HgS + HgSO_4$. Several reactions of (I) are described. L. S. T.

Use of mercuric acetate as an oxidising agent. —See A., 1940, II, 151.

Polyborates. A. FERRARI (Atti X Congr. Internaz. Chim., 1938, II, 634—638; cf. A., 1938, I, 264).—K, Rb, Cs, and NH_4 borates can all be represented by the general formula $M_2B_{2n}O_{3n+1},(n + 2)H_2O$. If it is assumed that the cation contains 1 mol. H_2O of crystallisation the modified formula $[M(H_2O)]_2B_{2n}O_{3n+1},nH_2O$ corresponds with that of the Tl^I borates previously described. The smaller tendency of Tl^I to become hydrated is probably due to the large no. of extranuclear electrons, which screen the attraction between the positive nucleus and the O of H_2O. The composition of the hydrated NR_4 borates agrees with the suggested structures of the boric acids. O. J. W.

Action of carbon monoxide, carbon dioxide, and mixtures of both on aluminium powder. P. G. PATERNOSTO and J. DE SANTIBAÑES (Rev. Fac. Cienc. Quím. La Plata, 1939, **14**, 37—42).—Al reacts with CO and CO_2 at a dull red heat, especially in presence of $AlCl_3$, to give Al_2O_3 and C with a little Al_4C_3. F. R. G.

Chemical and structural properties of aluminium fluoride and double salts derived from it. V. CAGLIOTI (Atti X Congr. Internaz. Chim., 1938, II, 604).—Various reactions giving artificial cryolite have been studied. The genetic and structural relationships between pseudo- and natural chiolites have been determined. AlF_3 can form products with HF and H_2O which have a structure analogous to that of pseudo-chiolite $NaAlF_4,xH_2O$. O. J. W.

Aluminium carbide. Preparation from smoke-black and aluminium powder. P. G. PATERNOSTO and J. DE SANTIBAÑES (Rev. Fac. Cienc. Quím. La Plata, 1939, **14**, 43—47).—Dry smoke-black heated with excess of Al powder for 45 min. at 1000° in a Leune crucible yields 39—40% Al_4C_3. The combustion of the excess of Al aids the reaction. F. R. G.

Integral purification of gadolinium. L. ROLLA (Atti X Congr. Internaz. Chim., 1938, II, 766—769).—The removal of traces of Eu by means of reduction with Sr amalgam from a Gd prep. previously used for measurements of μ (cf. A., 1936, 1453) is described. O. J. W.

Preparation of pure holmium [compounds]. W. FEIT (Z. anorg. Chem., 1940, **243**, 276—287).—Details of the fractionation (bromates and basic nitrates) are given. F. J. G.

Effect of transition processes and of aggressive gases on the reactivity of silica. J. A. HEDVALL and K. OLSSON (Z. anorg. Chem., 1940, **243**, 237—245).—The formation of Ca_2SiO_4 from CaO and quartz is discontinuously accelerated in the neighbourhood of the transition point (~870°). Small additions of Na_2WO_4 or NaCl markedly accelerate the reaction in stability regions as well as near the transition point. Tridymite (I) is more reactive than cristobalite, and this > α-quartz. Previous treatment with Cl_2 at 900°, but not with CO at 900° or H_2 at 1100°, increases the reactivity of (I). Admixture of C has no effect. F. J. G.

Stability of peroxidised titanium solutions. G. H. AYRES and E. M. VIENNEAU (Ind. Eng. Chem. [Anal.], 1940, **12**, 96).—No fading of the yellow colour of Ti in H_2SO_4–H_2O_2 could be detected after keeping for 2 years in glass-stoppered Pyrex bottles without protection from light. L. S. T.

Titanium. XIV. Anatase and rutile structures in precipitates. A. V. PAMFILOV and E. G. IVANTSCHEVA (J. Gen. Chem. Russ., 1939, **9**, 1739—1741).—TiO_2 pptd. from aq. $TiCl_4$ has the rutile, and from aq. $Ti(NO_3)_4$ or $Ti(SO_4)_2$ the anatase, structure. In general, the latter structure is obtained in presence of complex-forming ions. R. T.

Oxidation of lead in air in presence of distilled water. M. TABOURY and NERISSON (Atti X Congr. Internaz. Chim., 1938, II, 808—812).—Air attacks Pb in presence of distilled H_2O or of practically

pure H_2O from granitic districts to give a cryst. compound having the composition of hydrocerusite $2PbCO_3,Pb(OH)_2$, which is slightly sol. in H_2O (0·6—0·8 mg. Pb per l.). O. J. W.

Lead compounds with polynuclear cations. E. Brasi (Atti X Congr. Internaz. Chim., 1938, II, 600—603).—By the action of 20% KNO_3 solution on aq. basic Pb acetate at room temp. a *compound* $[Pb_4(OH)_4OAc](NO_3)_3,2H_2O$ is pptd. At higher temp. only a basic nitrate $[Pb_2(OH)_2](NO_3)_2$ is obtained. O. J. W.

Chlorogermanic acid and the chlorogermanates. Properties and crystal structure of cæsium hexachlorogermanate. A. W. Laubengayer, O. B. Billings, and A. E. Newkirk (J. Amer. Chem. Soc., 1940, **62**, 546—548).—$GeCl_4$ was added to an equal vol. of 12N-HCl to give a two-liquid layer system. No crystals appeared on cooling to —49°. No solid separated at > —49° on bubbling HCl through cold anhyd. $GeCl_4$. Electrolysis of $GeCl_4$ in 6N-HCl shows migration of Ge to the anode due presumably to the presence of $GeCl_6''$ ions. Addition of aq. NH_3 to 12N-HCl saturated with $GeCl_4$ gave no chlorogermanate. LiCl, NaCl, KCl, CsCl, and $CaCl_2$ did not react when refluxed with anhyd. $GeCl_4$. Addition of $GeCl_4$ to a solution of CsCl in EtOH and 12N-HCl (1 : 2) gave a flocculent yellowish-white ppt. which, on drying, became a light yellow powder, *cæsium hexachlorogermanate*, Cs_2GeCl_6, readily sol. in H_2O and rapidly hydrolysed, insol. in 12N-HCl. Cs_2GeCl_6 is stable in dry air at room temp. but is decomposed without melting, slowly at 160° and rapidly at 200°. The crystals are isotropic and octahedral, n 1·68, ρ^{25} 3·45±0·01, with a face-centred cubic lattice, Ge—Cl distance 2·35 A. W. R. A.

Dissociation of ammonium sulphide. M. A. Damiens (Atti X Congr. Internaz. Chim., 1938, II, 623).—In presence of sufficient H_2O NH_4HS is almost completely dissociated into a solution of NH_3 and gaseous H_2S. O. J. W.

Phosphoniates. IV. Action of phosphine on cuprous, silver, and aurous halides. R. Höltje and H. Schlegel (Z. anorg. Chem., 1940, **243**, 246—251; cf. A., 1931, 583).—Tensimeter curves indicate the existence of the following compounds: $CuCl,PH_3$; *$CuCl,2PH_3$*; $CuBr,PH_3$; *$CuBr,2PH_3$*; *CuI,PH_3*; $CuI,2PH_3$; $2AgI,PH_3$; *AgI,PH_3*; *AuI,PH_3*. Heats of formation, from the curves, range from 8·6 to 12·4 kg.-cal. per g.-mol. of PH_3. F. J. G.

Strongly luminescent oxidation provoked by ozone. E. Briner (Helv. Chim. Acta, 1940, **23**, 320—322).—A blue flash accompanies the passage of a bubble of dil. O_3 through a solution of luminol (aminophthalhydrazide). 0·002 μg. of O_3 can be detected in this way. F. J. G.

Fluorination of thionyl chloride. H. S. Booth and F. C. Mericola (J. Amer. Chem. Soc., 1940, **62**, 640—642).—Fluorination of $SOCl_2$ by SbF_3 yields SOF_2 50, *thionyl chlorofluoride*, SOClF 20, SO_2 5, and unchanged $SOCl_2$ ~25%. The v.p. of SOF_2 and SOClF are respectively: log P (mm.) = 30·333 — 1908·4/T — 8·1053 log T and log P = 7·0466 — 1278·2/T + 0·1268 log T. W. R. A.

Selenium oxychloro-compounds of pyridine, pyridinium chloride, and related substances. J. Jackson and G. B. L. Smith (J. Amer. Chem. Soc., 1940, **62**, 544—546).—$SeOCl_2$ with C_5H_5N, quinoline, and *iso*quinoline yields two series of *compounds*, *e.g.*, $C_5H_5N,SeOCl_2$ and $(C_5H_5N)_2,SeOCl_2$, which have been isolated. C_5H_5N etc. act as bases in $SeOCl_2$. From $SeOCl_2$, C_5H_5NHCl and quinolinium chloride crystallise with 2 mols. of $SeOCl_2$. *iso*Quinolinium chloride appears to give a mixture of mono- and di-solvate. W. R. A.

Reaction between ammonia and $SeO_2,2HCl$ and $SeO_2,2HBr$. J. Jackson and G. B. L. Smith (J. Amer. Chem. Soc., 1940, **62**, 543—544).—In the reaction between NH_3 and $SeO_2,2HCl$ or $SeO_2,2HBr$, $(NH_4)_2SeO_3$, NH_4X, and $(NH_4)_2SeO_2X_2$ (X = Cl, Br) are formed. $SeO_2,2HX$ is an equilibrium mixture, $H_2SeO_2X_2 \rightleftharpoons SeOXH_2O{\cdot}X$. W. R. A.

Oxidation of ketones with selenium dioxide.—See A., 1940, II, 154.

Separation of optical antipodes. Its importance for the development of optical activity. G. Karagunis and G. Coumoulos (Atti X Congr. Internaz. Chim., 1938 II, 278—282).—Using the chromatographic technique it has been shown that the d- and l-forms of $[Cr\ en_3]Cl_3$ can be separated from one another to a small extent by selective adsorption at the surface of optically active SiO_2 crystals. O. J. W.

Electrochemical extraction of polonium. D. M. Ziv (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 743—746).—Broken tubes containing Ra disintegration products are boiled in aqua regia and the solution is evaporated to dryness and redissolved in 0·1N-HCl (3 c.c.). The product is treated with 0·005M-quinhydrone in 0·1N-HCl, and a Pt disc is rotated in the mixture for 30—45 min., when ~97% of the activity is transferred to the Pt. Longer periods are required for the deposition of Po on Ag. J. W. S.

Chemical activation by isomeric radioactive transition; reaction of ^{80}Br (18 min. half-life) with carbon tetrachloride. J. E. Willard (J. Amer. Chem. Soc., 1940, **62**, 256—261).—Decay and growth curves of the activities involved clearly demonstrate the existence of the reaction between $CHCl_3$ and Br activated as a result of the radioactive transition from ^{80}Br (4·4 hr.) to ^{80}Br (18 min.). This reaction is independent of temp. (—190° to 25°) and has an efficiency in the liquid phase ~3 times that in the solid phase. Only those ^{80}Br (18 min.) atoms react which are formed with the emssion of a conversion electron. The recoil energies previously considered to account for chemical activation by the isomeric radioactive transition of Br atoms are, in the light of the new data, too small to effect this. W. R. A.

Protective films on iron from the vapour of silico-organic compounds. I. D. Judin (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 614—617).—Polished Fe surfaces, when exposed to the vapour of $Si(OEt)_4$ at ~300° for 15—20 min., acquire a film with highly anticorrosive properties, being resistant to

a 3% solution of NaCl for five months and to saturated I vapour for 2 hr. C. R. H.

Reactivity of the α and γ varieties of ferric oxide. V. CAGLIOTI and G. MILAZZO (Gazzetta, 1939, **69**, 802—809).—The stable α-phase adsorbs brilliant-green, but the γ-phase behaves as an acid and does not adsorb when in the pure state. O. J. W.

Decomposition of Prussian-blue by means of 2 : 2′-dipyridyl. G. A. BARBIERI (Atti X Congr. Internaz. Chim., 1938, II, 583—586).—An acid solution of Prussian-blue (I) is decomposed quantitatively in the cold by 2 : 2′-dipyridyl with the formation of a $[Fe(C_{10}H_8N_2)_3]^{\cdot\cdot}$ complex. If this is pptd. as the insol. ClO_4' compound the filtrate is found to contain $[Fe(CN)_6]'''$ ions. This is in agreement with the polynuclear structure of (I). O. J. W.

Inner complex salts of 8-hydroxyquinoline-5-sulphonic acid. J. MOLLAND (J. Amer. Chem. Soc., 1940, **62**, 541—542; cf. A., 1940, I, 126).—On addition of aq. $Fe_2(SO_4)_3$ to aq. 8-hydroxyquinoline-5-sulphonic acid (I) the mixture is deep green and the colour is discharged by $CuSO_4$. No appreciable change in colour occurs on adding $CuSO_4$ to (I). The deep green colour must arise from an inner complex Fe salt and Fe is replaced by Cu to give a colourless Cu salt. The compositions of these salts have been investigated spectrophotometrically and their formulæ are $(C_9H_6O_4NS)_3Fe$ and $(C_9H_6O_4NS)_2Cu$. W. R. A.

Higher oxide compounds of iron. P. V. GOGORISCHVILI, V. N. KULGINA, and O. E. ZVJAGINTZEV (J. Gen. Chem. Russ., 1939, **9**, 1961—1966).—The green salt obtained by fusion of Fe_2O_3 with Na_2O_2 and $KClO_3$ at 400—470°, and claimed by Goralevitsch (A., 1927, 433) to be Na_2FeO_5, is in reality a Mn compound; it is not obtained from pure Fe_2O_3. The same applies to the deep blue product obtained similarly by fusion in a Au crucible. Mn-free Fe_2O_3 may be prepared from $Fe(OH)_3$ pptd. with C_5H_5N, but not with aq. NH_3. It is concluded that salts of Fe^{VIII} have not yet been prepared. R. T.

Higher ammoniates of complex compounds. Tensimetric determinations. G. SPACU and P. VOICHESCU (Z. anorg. Chem., 1940, **243**, 288—296).—Tensimeter curves at −76·5° to 19° for complex salts in presence of NH_3 indicate the existence of the following higher *ammoniates*: $[Co(NH_3)_6]Cl_3,xNH_3$ and $[Cr(NH_3)_6]Cl_3,xNH_3$, $x = 8, 2, 1$; $[Cr(NH_3)_5Cl]Cl_2,xNH_3$, $x = 4, 1$; $[Co\ en_3]Cl_3,4NH_3$; $[Cr\ en_3]Cl_3,xNH_3$ and $[Ni\ en_3]Cl_2,xNH_3$, $x = 4, 2$; *trans*-$[Co\ en_2Cl_2]Cl,xNH_3$, $x = 4, 2, 1$; *cis*-$[Co\ en_2Cl_2]Cl,xNH_3$, $x = 6, 4, 2, 1$. They have the same colour as the original complex salt and lose all of the excess NH_3 at room temp. Heats of formation calc. from the curves, and ranging from 9 to 16 kg.-cal. per g.-mol. of NH_3, are given. F. J. G.

Method for determining the composition of mixtures by thermal analysis. B. W. SPEEKMAN and J. P. WIBAUT (Chem. Weekblad, 1940, **37**, 133—134).—The composition of a mixture $A + B + C$ . . . is determined from the Δf.p. in another solvent and in the pure components A, B. Thus a mixture of C_6H_6 and *iso*-C_8H_{18} is analysed by determining Δf.p. in $C_2H_4Br_2$ and C_6H_6. S. C.

Use of the photo-electric cell in acidimetry. R. MEURICE and A. DEVUYST (Ann. Chim. Analyt., 1940, [iii], **22**, 61—67).—Under suitable conditions, good results are obtained in the titration of acids or alkalis by determining the colour changes at the end-points by means of a photo-electric cell (Hellige photo-electric colorimeter). Curves for the titration, with NaOH, of 0·5N-HCl and/or 0·5N-H_2SO_4 [azolitmin, phenolphthalein (I), thymolphthalein (II), naphtholphthalein, Me-orange, Me-red, or eosin], of AcOH [(I), and (II)], and of mixtures of 0·5N-HCl and 0·5N-AcOH [tropæolin OO (III)] are given. Suitable comparison solutions containing indicator are used in all cases. Mixtures of a strong and weak acid are titrated for total acidity using (I), and for acidity due to the strong acid using (III). The error of these methods is ~0·5 mg. of acid. This use of the photo-electric cell is suitable for workers with defective colour-vision, or in conditions of poor lighting. L. S. T.

Analysis with the dropping mercury electrode. G. A. PERLEY (Canad. Chem., 1940, **24**, 85—88, 105).—A review.

Departure of the equivalence volume from the inflexion volume in potentiometric titrations. I. G. MURGULESCU and C. DRĂGULESCU (Z. physikal. Chem., 1939, **185**, 375—388).—Theoretical. Relations are deduced between the deviation of the inflexion point from the equivalence point and the solubility product or equilibrium const. in potentiometric titrations involving unsymmetrical pptn., complex-formation, and oxidation–reduction reactions. F. J. G.

Method for separating para-hydrogen from oxygen and carbon monoxide. E. BERGMANN, L. FARKAS, and L. SANDLER (J. Amer. Chem. Soc., 1940, **62**, 445).—In most instances satisfactory separation of p-H_2 from other gases can be achieved by freezing out the common gases with liquid or solid air. This method is not applicable, however, when O_2 or CO is present, and the possible use of liquid H_2 here is prohibitive economically. A chemical separation, based on the preferential solubility of O_2 and CO in various solutions, without initiating p–o conversion, has therefore been devised. For the absorption of O_2 a saturated solution of CPh_3Na in Bu_2O was used, and for CO the Cu_2O–NH_3 solution. In both instances p–o conversion is negligible. W. R. A.

Indirect determination of hydrochloric and hydrobromic acids by conversion of the silver chloride into silver bromide. G. G. LONGINESCU and E. I. PRUNDEANU (Bul. Chim. Soc. Române, 1938, **39**, 15—16).—The AgCl and AgBr are pptd. in a Jena crucible (IG4) and weighed. The crucible is placed in a Witt filtering apparatus, and 5 c.c. of conc. aq. NH_3 are mixed with the ppt. Several c.c. of warm aq. KBr are then added to convert the AgCl into AgBr, and pptn. is completed by the addition of HNO_3. Liquid is prevented from passing through the crucible at this stage by compressing the air in the Witt apparatus by means of a rubber bulb.

After washing with H_2O and drying at 130°, the AgBr and crucible are weighed. The results are accurate to 0·2%. For mixtures of Br′ and I′, the AgBr is dissolved in aq. NH_3, and pptd. as AgI with aq. KI. L. S. T.

Metabisulphite method for determination of residual chlorine [in chlorinated sulphite pulp].—See B., 1940, 269.

Extremely sensitive method for the determination of traces of oxygen in gases. A. G. NASINI and P. L. MAY (Atti X Congr. Internaz. Chim., 1938, III, 441—450).—The diminution of the intensity of the phosphorescence of certain org. compounds, adsorbed on SiO_2 gel, in the presence of traces of O_2 can be used to determine traces of this gas. Using a W arc as light source and a Pulfrich photometer for measurement purposes, the effect of temp. on the intensity of the phosphorescence of trypaflavine, and its change after interruption of excitation and after admission of O_2, have been investigated. The method can be used to determine partial pressures of O_2 $\nless 10^{-5}$ mm. J. W. S.

Determination of elementary sulphur dissolved in organic liquids. B. S. RAO and M. R. A. RAO (Atti X Congr. Internaz. Chim., 1938, III, 462—465).—The liquid is shaken with Hg at 50° and the HgS produced is treated in absence of air with aq. HCl containing KI and H_3PO_2. The H_2S liberated is swept away in a current of H_2, absorbed in an aq. suspension of $Zn(OH)_2$, and determined by titration with I or methylene-blue. J. W. S.

Potentiometric determination of sulphides and of alkali ferricyanides. G. SCAGLIARINI (Atti X Congr. Internaz. Chim., 1938, III, 466—469).—The reactions between $K_3Fe(CN)_6$ and alkali sulphides follow the course $2Fe(CN)_6''' + S'' = 2Fe(CN)_6'''' + S$. A similar reaction occurs with alkali metal selenides. These reactions can be used for the electrometric titration of $Fe(CN)_6'''$ and S″ or Se″, alone or in the presence of other alkali salts. The electrodes used comprise a Pt wire immersed in the solution and a Hg_2Cl_2 electrode, separated from the titration vessel by a bridge of saturated aq. KCl. J. W. S.

Volumetric analysis of sulphite solutions containing selenium. R. C. SHAVER and C. R. MCCROSKY (Ind. Eng. Chem. [Anal.], 1940, **12**, 74—76; cf. A., 1937, I, 530).—Details are given of a method based on the oxidation of colloidal red Se to H_2SeO_3 and of SO_3'' to SO_4'' by $KBrO_3$ in presence of acid. All but 1 ml. of the standard $KBrO_3$ required is added to the solution containing $SO_3'' +$ Se and starch (protective colloid and indicator) before 6N-HCl is added. The titration with $KBrO_3$ is completed using Bordeaux-red as indicator or, preferably, the Sullivan–Smith electron beam sectrometer (*ibid.*, 267). The H_2SeO_3 formed is then titrated with standard $Na_2S_2O_3$ and I (cf. *ibid.*, 579). The results agree with gravimetric methods to within 0·4% for Se and 0·2% for SO_3''. L. S. T.

Precipitation of barium sulphate in presence of ammonium chloride. J. T. MCHENRY, G. A. AMPT, and E. HEYMANN (J. Amer. Chem. Soc., 1940, **62**, 448—449).—To 200 c.c. of a boiling solution containing 0·1859 equiv. of $(NH_4)_2SO_4$ and varying amounts of NH_4Cl, 19 c.c. of 1·96N-aq. $BaCl_2$ were slowly added. The ppt., washed and dried, was examined for sorbed materials by (i) dissolving 1-g. portions in 10 c.c. of cold conc. H_2SO_4, the solution being poured into 200 c.c. of boiling H_2O, the liquid filtered, the ppt. washed, and the filtrate made alkaline and distilled; the NH_3 liberated was dissolved in HCl and the excess of acid determined iodometrically, and (ii) dissolving the 1-g. portions in 200 c.c. of 50% aq. NaOH by warming, the solution being diluted to 500 c.c. and distilled; NH_3 was determined as before. ~50% of the NH_3 is present in the ppt. as $(NH_4)_2SO_4$, and a linear relation exists between the $[(NH_4)_2SO_4]$ sorbed and the $[NH_4Cl]$ at pptn. The view of Kolthoff and MacNevin (A., 1936, 791) and others, that the essential process in the inclusion of foreign material in $BaSO_4$ ppts. is a sorption on the initially formed primary crystallites, is supported by the very slow liberation in (ii) of NH_3. The growth of the initially sorbed material is such that it does not easily find its way out of the internal structure of the macrocrystal. This point is incompatible with adsorption on the external surface of the macrocrystals only. W. R. A.

Sodium furoate as preservative [of thiosulphate and starch solutions]. A. M. PLATOW (Chemist Analyst, 1939, **28**, 30—31; Int. Sugar J., 1940, **42**, 69).—N-$Na_2S_2O_3$ to which 0·1% of Na furoate (I) had been added preserved its normality for 3 months. Furoic acid as well as (I) (0·1%) preserved starch solution indefinitely without settling occurring. J. P. O.

Azoxylidine and the nitrites. F. C. ALZAMORA (Bol. Soc. Quím. Peru, 1939, **5**, 240—241).—$NaNO_2$ is determined colorimetrically with $C_6H_3Me_2{\cdot}N{:}N{\cdot}C_{10}H_6{\cdot}ONa$. F. R. G.

Manometric determination of nitrite in solution and in tissue.—See A., 1940, III, 462.

Gravimetric determination of carbon in lead concentrates.—See B., 1940, 285.

Detection of carbon monoxide.—See B., 1940, 329.

Limits of detection of heavy rare gases in helium. B. KARLIK (Sitzungsber. Akad. Wiss. Wien, 1936, II*a*, **145**, 145—161; Chem. Zentr., 1937, i, 3836).—The gas is confined at 0·5 mm. pressure in a 1—1·5-mm. quartz capillary 4—6 cm. long, lying along the optic axis of the spectrograph, and excited by a high-frequency oscillator. The limits of detection, using the lines given in parentheses, are as follows: Ne (red lines), $2—3 \times 10^{-5}$; A (4609), 2×10^{-4}; Kr (4319), 2×10^{-5}; Xe (4079 or 2475·9 A.), 3×10^{-5} vol.-%. The limits are generally somewhat lower if ultra-violet lines are used. These % limits represent $\sim 10^{-7}$ cu. mm. of gas. A. J. E. W.

Adsorptional method of separating krypton and xenon. I. V. G. FASTOVSKI (J. Gen. Chem. Russ., 1939, **9**, 1666—1673).—A and O_2 are separated from Kr and Xe by passing the mixture over SiO_2 gel at low temp. (−120°), removing O_2 and A by lowering

the pressure, and then desorbing Kr and Xe by raising the temp. R. T.

Direct determination of some elements from their flame spectra by the photo-electric method. L. MAZZA (Atti X Congr. Internaz. Chim., 1938, III, 438—441).—Metals with relatively simple emission spectra (Li, Na, K, Rb, Cs, Ca, Ba, Sr, Tl) can be determined directly from the intensity of their flame spectra. The radiation emitted from a flame to which the metal salt is fed is passed through a suitable filter with transmission over only a narrow wave-band, and the intensity is measured with a photo-electric cell. To avoid irregularities due to the difficulty of producing a const. light source, either the photo-cell is connected in parallel with a suitable condenser, or the substance is introduced into a Pt tube, sealed at one end, from which it feeds continuously to the flame. J. W. S.

Quantitative emission spectrum analysis of inorganic elements in solution. H. LUNDEGÅRDH (Landtbruks-Högskolans Ann., 1936, **3**, 49—97; Chem. Zentr., 1937, i, 3833).—A discussion of flame and dipping spark methods. In the flame max. emission is observed 9 (Cs), 15 (K, Na), 3 (alkaline earths), or 12 mm. (Co, Fe) above the tip of the blue cone. A detailed examination of the effect of foreign elements (particularly Na) on the spark line intensities shows that elements of low ionisation potential should be removed before analysis, unless the reference solutions contain equal concns. of these elements. The use of a liquid spark electrode is discussed. A. J. E. W.

Detection of silver in very dilute solutions by physical development. A. I. VELCULESCU (Bul. Chim. Soc. Române, 1938, **39**, 141—143).—An atm. of H_2S replaces the aq. KBr used in the test described previously (A., 1932, 1222); the H_2S can be removed more easily in the washing with H_2O. K_2S is difficult to remove, and cannot replace H_2S. The metol developer is satisfactory, but a developer containing 4 g. of pyrogallol and 4 g. of citric acid per l., and to 60 c.c. of which 2 c.c. of 0·1M-$AgNO_3$ are added immediately before use, gives a more intense Ag spot. $Pb^{\cdot\cdot}$ interferes with the test when H_2S is used instead of KBr. L. S. T.

Determination of ash in organic compounds by micro-technique.—See A., 1940, II, 199.

[Analysis of dusts.]—See B., 1940, 329.

Separation of calcium from barium and strontium [nitrates] by the alcohol method. G. G. LONGINESCU and N. IORDACHE (Bul. Chim. Soc. Române, 1938, **39**, 17—18).—Traces of $Ca^{\cdot\cdot}$ can be separated from large amounts of $Ba^{\cdot\cdot}$ and $Sr^{\cdot\cdot}$ by treating the mixed carbonates with a mixture containing 90 vols. of 96% EtOH and 10 of conc. HNO_3, in which $Ca(NO_3)_2$ is sol. Attempts to utilise the separation quantitatively give low results for Ca. L. S. T.

Determination of sub-micro-quantities of calcium. A. E. SOBEL and I. A. KAYE (Ind. Eng. Chem. [Anal.], 1940, **12**, 118—120; cf. A., 1939, III, 954).—Details for the volumetric determination of 0·004—0·0400 mg. of Ca with an average % deviation of $\pm$1·2 using an ordinary 5—10-c.c. micro-burette are described. $Ca^{\cdot\cdot}$ is pptd. as CaC_2O_4 (I) at p_H 3·5 (bromothymol-blue) in a specially-designed Pyrex centrifuge tube, washed with aq. $(NH_4)_2C_2O_4$, and converted into $CaCO_3$ by heating. The $CaCO_3$ is dissolved in 0·01N-HCl, and the excess of acid is determined by adding aq. KIO_3 and KI, and titrating with 0·0007N-$Na_2S_2O_3$ (starch). The method has been applied to the determination of Ca in blood-serum, and agrees with the acidimetric method described previously (A., 1938, I, 212). L. S. T.

Colorimetric determination of magnesium with "titanium yellow." H. GINSBERG (Z. Elektrochem., 1939, **45**, 829—833; cf. B., 1939, 54).—Max. absorption in solutions containing the lake of $Mg(OH)_2$ and "Ti yellow" (I) (concn. c) is at ~5460 A. The extinction coeff. (ϵ) curve is linear only if c is $\nless$ a crit val.; with lower c the ϵ/c curve bends continuously owing to progressive shift of an equilibrium between the lake and (I). Although the Mg : (I) ratio in the lake is nearly const., the latter is an adsorption compound; addition of $Mg^{\cdot\cdot}$ to a solution containing the crit. c causes a deepening in colour, and ϵ approaches asymptotically to a const. val., indicating that lake formation is governed by normal adsorption laws. Similar observations with the lake of $Al(OH)_3$ and eriochromecyanine-*R* are recorded. A method of correcting for excess of (I) in solution during colorimetric analysis is explained. A. J. E. W.

Modification of Rauscher's method for determining mercury. A. SHUKIS, jun., and R. C. TALLMAN (Ind. Eng. Chem. [Anal.], 1940, **12**, 123).—In the volumetric application of this method (A., 1938, I, 473), all operations are carried out in a centrifuge tube to avoid loss. Centrifuging ensures complete recovery of the Hg, especially of the particles that tend to remain on the surface of the amine used for reduction. The time of heating should be extended from 5 to 15 min. L. S. T.

Determination of cerium with 8-hydroxyquinoline. T. I. PIRTEA (Bul. Chim. Soc. Române, 1938, **39**, 83—85).—10—20 c.c. of aq. $Ce(NO_3)_3$ are diluted with an equal vol. of H_2O; 5 c.c. of 2N-AcOH and a small excess of 3% alcoholic solution of 8-hydroxyquinoline are added. 10% aq. NH_3 is then added until pptn. is complete. The yellowish-orange ppt. is ignited to CeO_2 or, when the change of colour to purple-brown (1—10 days) is complete, the solution is heated to the b.p.; the ppt. is collected on a Jena glass crucible IG3, dried, and weighed as $Ce(C_9H_6ON)_4,2H_2O$. L. S. T.

Determination of praseodymium and neodymium in solution from their absorption spectra. J. N. FRIEND and D. A. HALL (Analyst, 1940, **65**, 144—148).—The effects of HNO_3 and of various nitrates on the intensities of the 5216, 5203, 5120, 5085, and 5770 A. absorption bands of Nd, and on the 5890 A. band of Pr have been investigated. The results indicate that, using a 6-cm. absorption cell, $Nd(NO_3)_3$ and $Pr(NO_3)_3$ can be determined separately in 3—4% solution (accuracy $\pm$1%) by visual comparison of the intensities of these bands with those of standard solutions. In the determin-

ation of Nd the max. permissible concns. of other nitrates are HNO_3 63, $Mg(NO_3)_2$ 70, $NaNO_3$ 85, $Ce(NO_3)_3$ 65, and $La(NO_3)_3$ 76 g. per l., and for the determination of Pr the max. concns. are HNO_3 50, $Mg(NO_3)_2$ 60, and $Ce(NO_3)_3$ 65 g. per l. $Nd(NO_3)_3$ can be determined in presence of $\not>$50% of $Pr(NO_3)_3$, but $Pr(NO_3)_3$ cannot be determined in presence of $Nd(NO_3)_3$. J. W. S.

Determination and possibility of fractionating the rare earths with 8-hydroxyquinoline. G. Mannelli (Atti X Congr. Internaz. Chim., 1938, II, 718—725).—All the elements of the rare-earth group can be pptd. quantitatively by 8-hydroxyquinoline. The ppt. can be weighed or determined bromometrically (cf. A., 1937, I, 47). The p_H necessary for pptn. has been determined potentiometrically. By suitable control of the p_H, Ce, Th, and Y can be separated by pptn. in this way from a crude rare-earth mixture. O. J. W.

Determination of aluminium and magnesium in light alloys.—See B., 1940, 287.

Determination of aluminium in ferrotungsten and tungsten steels.—See B., 1940, 284.

Ferrocyanides of manganese, zinc, and lead. D. I. Eristavi and D. N. Barnabischvili (J. Gen. Chem. Russ., 1939, 9, 1880—1886).—Mn^{II}, Zn, or Pb^{II} may be titrated with standard $K_4Fe(CN)_6$ in two ways: the salts are added to the $K_4Fe(CN)_6$ solution at 60—70°, until the colloidal solution flocculates, or, conversely, $K_4Fe(CN)_6$ is added to the solution of salt until the ppt. formed undergoes peptisation. In either case, the end-point corresponds with formation of $MnK_2Fe(CN)_6$, $Zn_3K_2[Fe(CN)_6]_2$, and $Pb_2Fe(CN)_6$, the solubility of which in H_2O at 18° is 6·72, 9·91, and 10·9 mg. per l., respectively. R. T.

Possible source of error in gravimetric determinations involving the use of hydrogen peroxide followed by nitron. R. C. Young and P. M. Bernays (Ind. Eng. Chem. [Anal.], 1940, **12**, 90).—NO_3' in the H_2O_2 used to oxidise Re_2S_7 to ReO_4' was responsible for high results obtained in determining ReO_4' by pptn. with nitron. L. S. T.

Separation of iron and manganese by the acetate process; p_H measurements; influence of H_2O_2. R. Höltje [with A. Scheer and C. Opitz] (Z. anorg. Chem., 1940, **243**, 252—258).—From dil. $FeCl_3$, $Fe(OH)_3$ is pptd. in the p_H range 3·5—6·0; in presence of NaOAc the range is 4·6—6·0. Pptn. of the basic acetate is best carried out at p_H 4·0—4·8 and 60—80°; co-pptn. of Mn is negligible at p_H <4·9 and small at p_H $\not>$6·0. Addition of H_2O_2 increases the co-pptn. of Mn, especially at higher p_H. F. J. G.

[Determination of iron in steel etc., using] perchloric acid.—See B., 1940, 284.

Analytical application of co-ordination compounds. G. Tartarini (Atti X Congr. Internaz. Chim., 1938, III, 469).—The additive compounds of $(CH_2)_6N_4$ with $MgCo(CN)_4$ and $MgIr(CN)_4$ are almost insol., whilst those with $MgNi(CN)_4$ and $MgPt(CN)_4$ are sol. This difference in solubility can be used for the separation of Co from Ni and of Ir from Pt. J. W. S.

Detection of molybdenum and tungsten. J. H. Hamence (Analyst, 1940, **65**, 152—154).—The solution (10 c.c.) is neutralised with NaOH or HCl, and conc. HCl (10 drops) and aq. thioglycollic acid are added. No colour is given with W but a bright yellow colour is produced in presence of Mo. On then adding dithiol [1 : 3 : 4-$C_6H_3Me(SH)_2$] (cf. A., 1937, I, 581) and boiling for 3—4 min. a dark green ppt. is obtained with Mo and a light greenish-blue ppt. with W. After cooling and adding excess of conc. aq. NH_3 a bright blue solution is formed in presence of Mo, whilst W gives a colourless solution. These reactions permit the detection of Mo, and after the removal of Mo with H_2S, the detection of W. J. W. S.

Determination of molybdenum in cast iron and steel.—See B., 1940, 281.

Spectroscopic analysis of tin.—See B., 1940, 285.

Volumetric determination of vanadium. H. Ragno (Atti X Congr. Internaz. Chim., 1938, III, 455—458).—Pure $K_2SnCl_4,2H_2O$ can be obtained by crystallisation from a solution saturated with HCl and, if protected from the action of air and light, can be kept unchanged for long periods. It can be used for standardising $KMnO_4$ and I. In the volumetric determination of V, the V^V solution, made slightly acid with H_2SO_4, is treated with standard K_2SnCl_4, the excess of which is determined by titration with standard I solution. J. W. S.

Photometric determination and separation of niobium, tantalum, and titanium in steel and ferro-alloys.—See B., 1940, 284.

Determination of gold by potentiometric titration. D. I. Rjabtschikov and G. V. Knjasheva (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 601—604).—In the potentiometric titration of Au, Au can be kept in the auric form by the addition of NaCl to form $Na[AuCl_4]$. The titration is carried out by means of p-$C_6H_4(OH)_2$ or $(NH_4)_2Fe(SO_4)_2$. Pt, Pd, and Rh do not interfere but in presence of Ir the potential jump corresponds with Au + Ir. With p-$C_6H_4(OH)_2$ a Au wire is used as electrode and conditions are improved by heating to 60—70°, by slightly acidifying with HCl, and by passing CO_2 through the solution. With $(NH_4)_2Fe(SO_4)_2$ a Pt plate electrode is suggested and the titration is carried out at room temp. C. R. H.

Electrical phenomena in a high-temperature laboratory furnace. H. E. Stauss (Ind. Eng. Chem., 1940, **32**, 446).—An account is given of difficulties experienced with thermocouples on account of thermionic emission and of their solution by a suitable arrangement of earthed shield. C. R. H.

Furnace for micro-Carius determination. J. A. Kuck and M. Griffel (Ind. Eng. Chem. [Anal.], 1940, **12**, 125—126).—In the furnace described and illustrated the time of heating to 250°, and also that of cooling from 300° to room temp., is reduced to 15 min. L. S. T.

High-temperature resistance type electric laboratory furnaces. W. M. HAZEL and W. J. O'LEARY (Ind. Eng. Chem. [Anal.], 1940, **12**, 109—112).—The construction and performance of a crucible furnace for high-temp. fusions and ignitions, and of a tube furnace for combustions, are described. The resistance wire, Ni–Cr, Kanthal, Pt, or Pt–Rh, according to the temp. required, is wound inside an alundum core, and is left exposed in order to obtain max. heat transfer. Temp. of 1000—1500° can be reached in the crucible furnace. L. S. T.

Simply constructed vacuum oven. W. G. WHITTLESTON (New Zealand J. Sci. Tech., 1939, **21**, B, 165—167). D. F. R.

Apparatus for drying small quantities of heat-sensitive solids. W. G. WHITTLESTON (New Zealand J. Sci. Tech., 1939, **21**, B, 162—163).—The solid is placed on the filter of a Buchner funnel, which is connected at the top by wide lagged tubing to a warmed H_2SO_4 bath. The system is kept evacuated and air allowed to leak in slowly through the acid and over the solid. Drying is 3—4 times as rapid as in a H_2SO_4 vac. desiccator. D. F. R.

Precision cryostat for the range —35° to 25°. E. E. ROPER (Ind. Eng. Chem. [Anal.], 1940, **12**, 113—117).—Details of construction and performance of an automatically-controlled cryostat of the liquid refrigerator type are given. Temp. can be maintained const. to within a few thousandths of 1°. L. S. T.

Production of low temperatures. Laboratory procedure. H. L. WIKOFF, B. R. COHEN, and M. I. GROSSMAN (Ind. Eng. Chem. [Anal.], 1940, **12**, 92—94).—Solid CO_2 is added to a suitable non-volatile solvent in large Dewar flasks of Pyrex glass insulated by cotton in a Cu container. Solvents recommended are $(CH_2\cdot OH)_2$ (—15°), dimethoxytetraethylene glycol (—31°), diethyl Carbitol (—52°), Carbitol acetate (—67°); Cellosolve, Cellosolve acetate, diacetone alcohol, and butyl Cellosolve (—73°). The properties and behaviour of other glycols and related products are tabulated and discussed. L. S. T.

Thermopile. H. F. LAUNER (Rev. Sci. Instr., 1940, **11**, 98—101).—An easily constructed, rugged, sensitive thermopile consisting of Chromel *p*-constantan junctions is described. N. M. B.

Vacuum thermocouple. G. E. MOORE and H. W. WEBB (Rev. Sci. Instr., 1940, **11**, 101—102).—Modifications and improvements of existing designs are described. N. M. B.

Apparatus for observing critical phenomena in the stationary state. W. SWIENTOSLAWSKI (Atti X Congr. Internaz. Chim., 1938, II, 533—536).—The apparatus consists of an annular, elliptical sealed glass tube, one arm of which can be heated so as to maintain a liquid in the crit. state. The occurrence of the stationary crit. phenomena can be observed in the other arm of the tube. A modified form of the apparatus allows the crit. temp. in the stationary state to be measured. O. J. W.

New method of microscopy in ultra-violet rays. E. M. BRUMBERG (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 473—476).—Three photographs are made with a microscope with quartz lenses and monochromator using a high-voltage spark between Cd electrodes as light source. The photographs are projected on to a screen and each is examined by a colour screen transmitting red, green, or blue light, or by a chromoscope. Three-colour fluorescent screens can also be used; photographing is then unnecessary. L. S. T.

Study of salts by the method of microphotometry of X-ray photographs. V. P. BLIDIN (J. Gen. Chem. Russ., 1939, **9**, 1899—1900).—The analysis of debyeograms is facilitated by comparing the microphotometer curves obtained in passing across the spots given by different compounds. The method is used to show that berkent ($2Na_2SO_4,Na_2CO_3$) differs in crystal structure from Na_2SO_4 and Na_2CO_3. R. T.

Apparatus for photometric grading of sands.—See B., 1940, 289.

Internally reflecting ultramicroscope objectives and their application to biology and other sciences. C. SPIERER (Arch. Sci. phys. nat., 1940, [v], **22**, 5—31; cf. A., 1926, 931).—A method for obtaining oblique illumination with a Spierer lens by means of a minute metal reflector placed eccentrically on the forward lens is described. Applications of the arrangement are illustrated and discussed by reference to photomicrographs of biological and chemical specimens. N. M. B.

Spectral photometry. D. VERMEULEN (Nederl. Tijds. Natuurk., 1937, **4**, 15—30; Chem. Zentr., 1937, i, 3833—3834).—A discussion dealing with the measurement of the spectral energy distribution for light sources, the use of visual, Geiger counter, thermal, photo-electric, and photographic methods in radiation measurement, and the calibration of reference standards. A. J. E. W.

Spectrophotometer for controlling colour. D. K. DONOVAN (Metal Ind., N.Y., 1939, **37**, Suppl., 4—6). L. S. T.

Simple method of coating optical surfaces with aluminium. M. V. SIVARAMAKRISHNAN (Indian J. Physics, 1939, **13**, 241—245).—The method of coating optical surfaces consists in enclosing the optical surface and Al in a vac. (10^{-4} mm. Hg) and vaporising the Al by passing a current through it. The apparatus described is convenient for the deposition of most metals on surfaces $\not> 6$ in. in diameter. The advantages of this method over chemical silvering and sputtering are discussed. W. R. A.

High-temperature camera for Debye–Scherrer photographs. W. BORCHERT and K. FISCHBECK (Z. Physik, 1939, **114**, 515—518).—A description of apparatus. L. G. G.

Apparatus for determining the orientation of crystals by X-rays. F. E. HAWORTH (Rev. Sci. Instr., 1940, **11**, 88—91).—With the apparatus described the orientations of single crystals and the crystals in polycryst. materials can be studied by X-rays by rotating the specimen and the cylindrical photographic film simultaneously; the rotations may be either continuous or in steps. N. M. B.

Polarising properties of Cellophane. D. Middlehurst and R. Weller (Rev. Sci. Instr., 1940, **11**, 108).—Data for sheets of Cellophane of various colours are reported. A suggested explanation is the lining up of particles of dye by the stroking action of the extruding process. N. M. B.

Optical method for measuring ultrasonic absorption in gases and liquids. O. Petersen (Physikal. Z., 1940, **41**, 29—36).—The theory and arrangement of an optical method for measuring ultrasonic absorption in gases and liquids are given, and experimental data are compared with the requirements of theory. W. R. A.

Theory of optical ultrasonic absorption measurements. E. David (Physikal. Z., 1940, **41**, 37—41).—Mathematical. W. R. A.

Photo-electric effect and applicability to chemical analysis. I. Sorgato (Chim. e l'Ind., 1940, **22**, 58—60).—The influence of the colour tone on the sensitivity of photocolorimetric measurements with various coloured solutions has been studied. Methods of increasing the spectral sensitivity of photocells are discussed. O. J. W.

Detection of surface layers by secondary variations of reflecting power. J. Loiseleur (Compt. rend., 1940, **210**, 369—371).—Previous immersion in various aq. solutions (0·0001—0·5N.) retards the attack of a silvered glass surface by aq. $(NH_4)_2S$ vapours, which is followed by measuring the reflecting power of the surface with a photo-cell. The retardation is nearly independent of the concn. of the solution and time of immersion (5 sec.—15 hr.), and increases in the order $AuCl_3$, KCl, K_2CrO_4, $SnCl_2$, H_2CrO_4. A unimol. protective film is probably formed in each case; Au layers 1 and 10 mols. thick have almost identical effects. A. J. E. W.

Cell for determination of oxidation–reduction potential. L. G. Zerfas and M. Dixon (Biochem. J., 1940, **34**, 365—370).—An anaërobic electrode vessel for determining potentials during enzymic reactions is described. It contains provision for adding several reagents successively to the enzyme solution without opening the apparatus, introducing traces of O_2, or interrupting the readings. All traces of O_2 can be removed from the cell, and there is no possibility of contamination of the solution with traces of reagents used in previous determinations. J. N. A.

Glass electrodes. A. H. W. Aten, (Miss) L. Boerlage, and J. E. Garssen (Chem. Weekblad, 1940, **37**, 158—166).—The Jena glass electrodes described by Kratz (A., 1939, I, 147) have been compared with older types of glass electrode, with confirmation of Kratz's results. p_H vals. obtained with the simplified circuit agree well with those obtained in the usual manner. D. R. D.

Operating characteristics of a voltage-multiplying circuit for nuclear disintegration experiments. S. K. Allison, G. T. Hatch, L. S. Skaggs, and N. M. Smith, jun. (Physical Rev., 1938, [ii], **53**, 204—205).—These are described for a circuit operated at 60 and 540 cycles. A horizontal tube for the acceleration of positive ions has been constructed. L. S. T.

Ionisation gauge. R. S. Morse and R. M. Bowie (Rev. Sci. Instr., 1940, **11**, 91—94).—The improved triode-type gauge described, for use at pressures $<10^{-4}$—$<10^{-7}$ mm., embodies the essential features of small electrical leakage to the plate, internal parts easily freed from occluded gas, high sensitivity, and a short and large-diameter connexion between the bulb and the vessel. N. M. B.

High-efficiency ion source. A. T. Finkelstein (Rev. Sci. Instr., 1940, **11**, 94—97).—In the ion source described, by making the electrons oscillate through the region occupied by the gas with energies corresponding with the max. ionisation probability, the ionisation efficiency of the electrons is increased without making the gas pressure excessive. The electronic space charge is used to withdraw the ion beam and hold the beam together. H ion beams of 150 ma. have been obtained. N. M. B.

Condenser for determination of dielectric constants of liquids. D. T. Williams and C. S. Copeland (Rev. Sci. Instr., 1940, **11**, 105—107).—The cylindrical condenser is so designed that it may be filled to a variable height with the liquid investigated, and ϵ can be determined free from errors due to stray capacitances. N. M. B.

Phenomena in a cloud chamber operated without a sweep field. A. Ruark and E. Pardue (Rev. Sci. Instr., 1940, **11**, 108—109).—In a relatively small chamber (6 in.) under the influence of cosmic rays, diffusion and recombination hold the ion density down to a point at which sharp tracks are easily observed without a sweep field. N. M. B.

Circuit for anti-coincidences with Geiger–Müller counters. G. Herzog (Rev. Sci. Instr., 1940, **11**, 84—85; cf. A., 1939, I, 445).—The low accuracy of results involving the differences of coincidences is overcome by the method of anti-coincidences. The circuit described has an effciency of 98·6%. N. M. B.

Theoretical obtainable resolving power of the electron microscope. O. Scherzer (Z. Physik, 1939, **114**, 427—434).—The effects of diffraction and aperture error are discussed and it is shown that the various forms of microscope have similar limits of resolution governed by the equation: $d \gtrsim \lambda/\sqrt{2} \times (f/\lambda)^{\frac{1}{4}}$ where f = focal length of objective, λ = electron wave-length, and d = min. separation of two object points. L. G. G.

Magnet and cloud chamber for cosmic-ray studies. H. Jones and D. Hughes (Rev. Sci. Instr., 1940, **11**, 79—83).—The large oil-cooled electromagnet described has pole faces 30·5 cm. diameter, air gap 19·2 cm., and operating at 35—125 kw. gives a field of 12,400—16,000 oersteds. The diaphragm type cloud chamber, 30 cm. diameter and 4·2 cm. deep, is filled with A and EtOH vapour at 88 cm. pressure. The probable error is 6% in energy measurements of a track of 10^9 ev., and about equal to the energy itself when this is $1·6 \times 10^{10}$ e.v. N. M. B.

Study of the hydration of thorium salts by means of emanating power and magnetic susceptibility. P. MISCIATTELLI (Atti X Congr. Internaz. Chim., 1938, II, 731).—Measurement of the emanating power of hydrated Th salts gives a more sensitive method of following structural changes during hydration than measurement of μ. O. J. W.

Barkhausen-Kurz oscillations with positive ions. W. S. ELLIOTT and J. A. RATCLIFFE (Nature, 1940, **145**, 265—266).—Oscillations of λ 500 m. have been obtained by using positive ions from a filament in a cylindrical triode. L. S. T.

Necessity of reducing analytical weights to normal temperature and pressure. C. J. VAN NIEUWENBURG (Atti X Congr. Internaz. Chim., 1938, III, 451—454).—An apparatus comprising a U-shaped barometer tube, containing above the Hg in the closed limb a small quantity of a mixture of C_6H_6 (45 vol.-%) and PhMe, is described. The changes in the level of the open limb due to changes in temp. and pressure $\propto$ the corrections which must be applied to reduce wts. measured in air to the wt. at 20° and 760 mm. J. W. S.

Application of Hempel four-bulb gas pipette. L. WOLF (J. pr. Chem., 1940, [ii], **154**, 284; cf. A., 1939, I, 539).—A similar apparatus has been designed by Fleissner (A., 1908, ii, 891). A. T. P.

Accelerated Orsat analysis [of gas].—See B., 1940, 258.

Laboratory still. E. RIETZ (J. Chem. Educ., 1940, **17**, 95).—A simple all-glass apparatus is described. L. S. T.

Properties of singly distilled water with filtering of the vapour. A. A. GUNTZ (Atti X Congr. Internaz. Chim., 1938, II, 656—666).—A distillation apparatus incorporating a filter for the vapour is described. H_2O with a sp. conductivity of $0{\cdot}5$—$1{\cdot}0 \times 10^{-6}$ mho can be obtained in a single operation. O. J. W.

Iodine [determination] apparatus. F. X. GASSNER (Ind. Eng. Chem. [Anal.], 1940, **12**, 120).—Changes in material, design, and construction of the metal torch designed by von Kolnitz and Remington (A., 1933, 242) are described. The apparatus is suitable for determining, *inter alia*, the I content of thyroid gland. L. S. T.

Compact gas saturator. A. E. MARKHAM (Ind. Eng. Chem. [Anal.], 1940, **12**, 112).—The apparatus described and illustrated is more satisfactory than wash-bottles of the Friedrichs or Milligan type. L. S. T.

Continuous extraction of aqueous solutions by acetone-light petroleum. M. WAYMAN and G. F. WRIGHT (Ind. Eng. Chem. [Anal.], 1940, **12**, 91).—Light petroleum + $COMe_2$ (1 : 3) is preferable to $COMe_2$ alone for extractions from aq. solutions containing inorg. salts. Apparatus for this purpose is described and illustrated. L. S. T.

Coni-cylindrical viscosimeter for measuring the visco-elastic characteristics of highly viscous liquids. A. R. LEE and J. B. WARREN (J. Sci. Instr., 1940, **17**, 63—67).—A rotating cylinder viscosimeter suitable for determining η from 10^3 to 10^8 poises is described. The lower ends of both inner and outer cylinders are tapered to form cones having a common apex forming the lower bearing point of the inner cylinder. In this way uncertain lower "end-effects" are eliminated since the viscous drag from a fluid bounded by two conical surfaces can be calc. C. R. H

Velocity of sound in air at temperatures below 0°. A. E. BATE (J. Sci. Instr., 1940, **17**, 68—69).—An apparatus consisting essentially of two tuneable bottle-pipe resonators with the bottle portions of fixed but different lengths has been used to measure sound velocity at low temp. The val. at $-78{\cdot}5°$ is 283 m. per sec. C. R. H.

Adjustable support for crucibles and dishes. H. C. LOCKWOOD (Analyst, 1940, **65**, 160).—The support comprises half of a small retort boss, drilled with a hole at ~45° to the screw. This hole is fitted with a metal wire which can carry a piece of pipeclay or SiO_2 tube. Three of these attachments are fastened on the sides of a triangular tripod, with the screw on the under side or pointing outwards, and the wires carrying the tubes pointing inwards and upwards. J. W. S.

New high pressures reached with multiple apparatus. P. W. BRIDGMAN (Physical Rev., 1940, [ii], **57**, 342—343).—A description of a more complete application of the technique of building up high pressures by a partial use of the system of pressure vessels, one within the other, and externally supported (cf. A., 1940, I, 155). N. M. B.

Vacuum core-sampler for deep-sea sediments. H. PETTERSSON and B. KULLENBERG (Nature, 1940, **145**, 306). L. S. T.

Geochemistry.

Geochemical significance of the inert gases in natural gases and especially in volcanic gases. U. SBORGI (Atti X Congr. Internaz. Chim., 1938, II, 796—802).—The importance of knowing the concn. ratios of the inert elements, especially the ratios He : A, A : N_2, and Kr : A, in studying the origin of natural gases is emphasised. O. J. W.

Isotopic composition of natural waters. N. PARRAVANO and B. PESCE (Atti X Congr. Internaz. Chim., 1938, II, 401—411).—*d* measurements on a large no. of natural H_2O samples show that the isotopic composition varies within narrow limits. Various reasons for the fractional separation of O isotopes in natural waters are discussed. O. J. W.

Isotopic composition of rain-water. N. PARRAVANO and B. PESCE (Atti X Congr. Internaz. Chim., 1938, II, 412—415; cf. preceding abstract).—Direct and interferometric measurements show that the *d*

of various samples of rain-H_2O does not differ from that of a standard H_2O by >1 µg. Rain-H_2O has [D] $<$ and [^{18}O] $>$ that of the standard H_2O.
O. J. W.

Carbon dioxide in Arctic and Antarctic seas. G. E. R. DEACON (Nature, 1940, **145**, 250—252).—A review.
L. S. T.

Medicinal and drinking waters from Havza. K. ÖMER (Z. allg. türk. Chemiker-Ver., 1936, **2**, 110—138; Chem. Zentr., 1937, i, 3999).—The H_2O has a radioactivity of 1·7 Mache units, a temp. of 49·8°, and contains total salts 0·58 g., free CO_2 44 mg., and semi-combined CO_2 138·6 mg. per l., with As and Fe.
A. J. E. W.

Determination of the regulating capacity in mineral waters. G. SCARAMELLI (Atti X Congr. Internaz. Chim., 1938, II, 802—807).—The regulating capacity (π) is defined as $\pi = d(-\log [OH])/dp_H$. Measurements of π–p_H curves for various mineral H_2O samples are recorded, and the val. of such measurements for H_2O analysis is discussed.
O. J. W.

Adsorptive properties of dust particles carried into salt lakes by wind and entering into the composition of lake silts. V. I. NIKOLAEV and E. I. RUDENKO (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 605—607).—Deposited dust particles (0·001—0·01 mm. in diameter) were washed until free from Cl′ and SO_4'', dried, and shaken with various brines. Ionic changes in the brines took place, $Na^{\cdot}$, $K^{\cdot}$, Cl′, and SO_4'' being adsorbed from and $Ca^{\cdot\cdot}$ and $Mg^{\cdot\cdot}$ passing into solution.
C. R. H.

Boxhole meteoritic iron, Central Australia. C. T. MADIGAN [with A. R. ALDERMAN] (Min. Mag., 1940, **25**, 481—486).—Fragments of Ni–Fe from the recently discovered Boxhole meteorite crater are very similar to those from the Henbury craters about 240 miles to the S.W. (A., 1933, 1136), showing twisted surfaces, a medium octahedrite structure, and practically identical chemical composition: Fe 91·77, Ni 7·80, Co 0·44, P 0·08, S 0·03, C 0·049, SiO_2 0·01, total 100·18.
L. J. S.

Neutron radiation of rocks. N. M. LIATKOVSKAJA and G. V. GROSCHKOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 747—750).—Previous results (A., 1938, I, 541) are attributed to the unequal absorption of γ-rays in the Fe and Cd screens used. Using an ionisation chamber filled with BF_3 as a slow neutron indicator, it has been shown that for rocks with radioactivity equiv. to $5-10 \times 10^{-9}$% of Ra the neutron emission is approx. the intensity of cosmic neutrons at sea level.
J. W. S.

Space-group of pyrrhotite. V. HICKS and S. S. SIDHU (Physical Rev., 1938, [ii], **53**, 207—208).—X-Ray data for single crystals of pyrrhotite (I) give a_0 3·453±0·009, c_0 5·670±0·020 A.; $\rho_{obs.}$ is 4·55, giving $\sim$2 mols. of (I) per unit cell. The most probable space-group is D_{6h}^4.
L. S. T.

Superstructure and magnetism of pyrrhotite. S. S. SIDHU and V. HICKS (Physical Rev., 1938, [ii], **53**, 207).—Evidence for the presence of a "superlattice" (cf. Hägg and Sucksdorff, A., 1933, 1235) in non-magnetic pyrrhotite (I) has been confirmed by powder diffraction spectra of natural and synthetic (I), but as the same evidence has also been obtained with natural and synthetic magnetic (I), the presence of a superlattice is not essential to the magnetic properties of the material.
L. S. T.

Beryl from C. Mondei near Montescheno (Val d'Ossola). L. PERETTI (R. C. Atti Accad. Ital., 1939, [vii], **1**, 63—66).—Crystallographic and other data are given. There are two varieties, a blue (I) and an olive-grey (II) form. (I) has *d* 2·718, SiO_2 64·95, Al_2O_3 17·24, Fe_2O_3 0·48, FeO trace, BeO 12·56, CaO 0·53, MgO 0·31, K_2O 0·50, Na_2O 0·84, Li_2O 0·13, H_2O 2·28, total 99·82%. (II) has *d* 2·726.
O. J. W.

Metamorphic differentiation in hartschiefer of Northern Sweden. H. A. BROUWER (Proc. K. Akad. Wetensch. Amsterdam, 1940, **43**, 142—148).—Petrological. The distribution of biotite and muscovite in the hartschiefer, and the processes involved in their formation and separation, are discussed.
L. S. T.

Lovozerite, a new mineral. V. I. GERASIMOVSKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 753—756).—Lovozerite,

$(H,Na,K)_2O,(Ca,Mn,Mg)O,(Zr,Ti)O_2,6SiO_2,3H_2O$,

has been located in the Lovozero alkaline massive in the Kola peninsula. It forms black opaque grains, $\not>$1—2 cm. long, with resinous lustre and *d* 2·384. It is insol. in HCl, HNO_3, and H_2SO_4. Its relationship to other minerals is discussed.
J. W. S.

Morphology of columbite crystals. E. D. TAYLOR (Amer. Min., 1940, **25**, 123—138).—The space-group of columbite obtained by Donnay's morphological method (A., 1940, I, 150) is *Pman* in the new setting $a : b : c = 0·4023 : 1 : 0·3580$. Sturdivant's X-ray data (A., 1931, 415) give *Pcan* in the same setting. The difference lies in the interpretation of the zone [100].
L. S. T.

Phlogopite deposits in extreme south of Madagascar. A. LACROIX (Compt. rend., 1940, **210**, 273—276).—The lower layers of the deposits described consist chiefly of phlogopite, pyroxene, and calcite; other associated minerals include allanite, containing much La and Ce with traces of Pr, Nd, Sm, and Th, and *seyrigite*, which occurs as lustrous yellow tetragonal crystals, optically positive, *d* 5·484. The seyrigite contains 24·01% of MoO_3, and is intermediate between scheelite and powellite. Many of the minerals occur as unusually large crystals.
A. J. E. W.

Secondary mineralogical transformations in the phlogopite deposits of the extreme south of Madagascar. A. LACROIX (Compt. rend., 1940, **210**, 353—357; cf. preceding abstract).—Dissolution and recrystallisation phenomena due to slow percolation of H_2O in deposits between the upper destruction zone and the intact phlogopite layers are discussed. The action of H_2O on phlogopite causes progressive hydration, loss of alkalis, and oxidation of Fe; the ultimate product is vermiculite. The constituents removed by the leaching process form quartz, opal, hydrated Mg silicate, sepiolite, etc.; the formations described include an unusual pseudomorphous, layered structure of quartz, due to deposition of SiO_2 during

dissolution of calcite or anhydrite. Prehnite and zeolites also occur. A. J. E. W.

Petrological study of the limestones in the Moine Series of Ardgour, Argyllshire. H. I. DREVER (Geol. Mag., 1939, **76**, 501—518).—The limestones associated with granulites and quartzites, diorite-gneiss, and serpentine are described. They vary considerably in chemical and mineral composition, and have been subjected to high-grade metamorphism. The mineral and chemical changes that have resulted from the metasomatising actions of solutions are described. L. S. T.

Mean chemical composition of the granitoids of the Zeravshan-Guissar mountain range (Middle Asia). I. V. BELOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 504—507).—Chemical analyses, some of them new, are tabulated, and discussed in relation to the nearest types of granites. L. S. T.

Rapakivi of Head Harbor Island, Maine. R. D. TERZAGHI (Amer. Min., 1940, **25**, 111—122).—The granite of this island has the textural peculiarities of a typical rapakivi, including coarse grain and large rounded K_2O felspar phenocrysts mantled by oligoclase. Occurrence and microscopic appearance suggest that the rock is of magmatic origin and not a product of granitisation. Chemical analyses of Marshfield granite, the perthite ovoids from the Head Harbor Island rapakivi, and the oligiclase of this rapakivi, are recorded. The composition and origin of the rapakivi group are discussed. L. S. T.

Iceland spar in Taos Co., New Mexico. J. H. JOHNSON (Amer. Min., 1940, **25**, 151—152).—The new commercial deposit of Iceland spar known as the Iceberg Lode Mining Claim is described. The deposit was formed probably by circulating warm waters, heated and mineralised by cooling lavas, which deposited calcite in a cavity in the fault. L. S. T.

Detrital dihexahedral crystals of quartz in a sediment in Upper Magdalena Valley of Colombia, S. America. J. W. BUTLER, jun. (Amer. Min., 1940, **25**, 145—151).—Small, well-developed dihexahedral crystals of quartz occur as a relatively abundant detrital component in a widespread formation in this locality. The quartzoids are considered to be of igneous origin; they were liberated for accumulation in the sediment during explosive volcanic eruptions and the subsequent weathering and disintegration of the parent andesitic and dacite lavas that occur in the Cordillera Central of the Colombian Andes. L. S. T.

Occurrence of felspar replacing fossils. B. STRINGHAM (Amer. Min., 1940, **25**, 139—144).—An unusual occurrence in limestone at Provo Canyon, Utah, of felspar crystals which are often contained within fossil skeletons is described. The origin of the felspar, which is probably authigenic, is discussed. L. S. T.

Lamellar structure of potash–soda felspars. S. H. CHAO and W. H. TAYLOR (Proc. Roy. Soc., 1940, **A**, **174**, 57—72; cf. A., 1939, I, 496).—The evidence for the existence of a monoclinic soda-felspar is critically discussed. G. D. P.

Occurrence of bismuthinite in Somerset. A. W. G. KINGSBURY (Nature, 1940, **145**, 351).—Thin veins and patches of bismuthinite associated with Cu minerals have been identified in waste-heaps of the Langham Hill Mine, formerly worked for Fe. L. S. T.

Kornerupine from Ceylon; a new occurrence. B. W. ANDERSON and C. J. PAYNE (Nature, 1940, **145**, 266).—Small amounts of kornerupine, ρ 3·33, α 1·671, β 1·683, γ 1·684, occur in gem gravel concentrates from Ceylon. L. S. T.

Blue rock-salt. J. N. FRIEND and J. P. ALLCHIN (Nature, 1940, **145**, 266—267).—Blue-tinted anhydrite from Cropwell Bishop, Notts, contains 4 p.p.m. of Au, and deep blue Stassfurt halite 23 p.p.m. Blue and pink halite from other localities, including Hallstadt and Wieliczka, also contain Au. The colour of halite may be connected with its Au content. L. S. T.

Geology of the area around Phonda and parts of Bavda Jahgir, District of Ratnagiri, Bombay Presidency. R. D. GODBOLE (Quart. J. Geol. Soc. India, 1939, **11**, 9—39).—The composition and structure of the laterite, Deccan trap, sandstones, quartzites, shales, gneisses, and schists in the rocks of the region are described in detail. A. R. P.

Minerals in Varuträsk pegmatite. I. Lithium manganese phosphates. P. QUENSEL (Geol. Fören. Stockholm Förhandl., 1937, **59**, 77—96; Chem. Zentr., 1937, i, 4080).—The minerals described are triphyllite, ferrisicklerite, heterosite, alluaudite, and bright olive-green varulite, $Na_2O,5(Mn,Fe,Ca)O,2P_2O_5$, with n_α 1·720, n_γ 1·732. A. J. E. W.

X-Ray study of bindheimite from Waitschach, near Hüttenberg, Carinthia. G. HÄGELE (Zentr. Min., **A**, 1937, 45—50; Chem. Zentr., 1937, i, 3617).—Powder photographs indicate a cubic lattice, a 10·41±0·01 A., space-group O_h^7, with a structure of the atopite type. A. J. E. W.

Olivinites of the Khabozero region (south-eastern part of the Kola Peninsula). V. A. AFANASIEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 513—516).—The intrusion of these olivinites on the Lesnaya Varaka is described. The ore olivinites consist of 5—60% of titaniferous magnetite, 90—40% of olivine (I), and the accessory minerals perovskite, leucoxene, and monoclinic pyroxene (II). The oreless olivinites contain 95—98% of (I), 4·5—1·5% of ore mineral, and rarely (II). Chemical and mineralogical analyses are tabulated. *Kolskite*, $5MgO,4SiO_2,4H_2O$ (analysis given), ρ 2·4, hardness >2, a new member of the serpentine group between deweylite and carachaite, occurs as a hydrothermal vein in the massif of olivinites. In air it loses absorbed H_2O and hardens. This deposit of olivinites represents a large source of refractory material for the steel industry. L. S. T.

Alkaline rocks of the Ozernaya Varaka of the Khabozero region (S.W. part of the Kola Peninsula). V. A. AFANASIEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 508—512).—Chemical and mineralogical analyses are tabulated and discussed. L. S. T.

Dependence of weathering of minerals on climatic conditions. P. ZEMIATSCHENSKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 496—499).—The weathering of muscovite from the Tchupa district, Karelia, and from Viatka has been investigated by means of chemical analyses of non-weathered and weathered specimens before and after treatment with 5% NaOH and 10% HCl. Under the conditions of a moderately cold and humid climate Al_2O_3 and alkalis are leached out, and SiO_2, MgO, and H_2O accumulate in the residual product. L. S. T.

Fluorite in the Kungur deposits of Tataria. L. M. MIROPOLSKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 500—501).—The occurrence of fluorite as inclusions in gypsum in two layers of dolomite is described. Chemical analyses of the dolomite are recorded. L. S. T.

Goyazite in the breccia of the Romny and Issachki salt domes. Z. N. PITKOVSKAJA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 502—503).—The occurrence of the rare mineral goyazite in a heavy mineral concentrate from a breccia of the Ukrainian salt domes is described, and its origin discussed. L. S. T.

Genesis of the Tamda emery deposits. A. F. SOSEDKO (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 493—495).—The ore deposits, which are confined to the upper part of the Upper Silurian marbles, are described, and the minerals present are recorded. The ore approaches bauxite ores in composition, and has been formed by metamorphism of sedimentary rocks rich in Al. L. S. T.

Magnetic observations of Nelson serpentinites. Geology of the asbestos deposits. W. M. JONES (New Zealand J. Sci. Tech., 1939, **21**, B, 128—142).—The asbestos-bearing serpentinites of Upper Takaka showed variations of 20,000 in vertical intensity and of 176° in declination. Those at Black Beach, D'Urville Island, showed a variation of 10,000 in vertical intensity but the small outcrop near Bird's Hill, Takaka, showed <1000. The development of chrysotile asbestos in the serpentinites is associated partly with contacts of the latter with sedimentary rocks and gabbro intrusives, and possibly also with the proximity of acidic intrusives. These contacts are clearly indicated by magnetic mapping. D. F. R.

Structure of orthoclase. S. H. CHAO, A. HARGREAVES, and W. H. TAYLOR (Min. Mag., 1940, **25**, 498—512).—Clear colourless felspar from Mogok, Upper Burma, containing K-felspar 91, Na-felspar 6·5, Ca-felspar 2·5% (A., 1937, I, 269), was examined by quant. *X*-ray methods with Fourier analysis and the position of the atoms determined from their electron-densities. The unit cell, *a* 8·60, *b* 13·02, *c* 7·22 A., β 63° 57′ (A., 1933, 892), contains 4 mols. $KAlSi_3O_8$, and the space-group is $C_{2h}^3 = C2/m$. L. J. S.

Bavenite in Switzerland. G. F. CLARINGBULL (Min. Mag., 1940, **25**, 495—497).—Pale brown radiating aggregates of platy fibres found in the Alpine veins in gneiss at Muotta Nera and at Val Casaccia in Graubünden have been identified as bavenite. The unit cell, *a* 19·34, *b* 23·06, *c* 4·95 A. (four times the size given by Ksanda and Merwin, A., 1934, 628), contains 4 mols. $Ca_4Al_2BeSi_9O_{24}(OH)_4$. Spectroscopic analysis shows the presence of Ge in the original bavenite from Baveno in Piedmont. L. J. S.

Appennine sandstones. G. CAROBBI (Atti X Congr. Internaz. Chim., 1938, II, 605—612).—Chemical composition and dehydration data are given. O. J. W.

New silicate of copper and calcium in the Vesuvian products. C. MINGUZZI (Atti X Congr. Internaz. Chim., 1938, II, 725—730).—A new blue mineral from the Vesuvian lava, for which the name cuprorivaite is proposed, has the composition $2[(Ca,Na)(Cu,Al)(Si,Al)_4(O,OH)_{10}],H_2O$. The biaxial, birefringent crystals are optically negative, the vals. of n being α 1·589, β 1·627, γ 1·6275; $2V = 13° 14'$. The mineral is strongly pleochroic, and has d^{20} 2·87. O. J. W.

Metasomatism of a shale to an igneous-appearing rock. G. E. GOODSPEED, R. E. FULLER, and H. A. COOMBS (Amer. Min., 1939, **24**, 186).—The sharp transition of a dark reddish-brown shale to a porphyritic dacite is described. L. S. T.

Symmetry and unit cell of hopeite. C. W. WOLFE (Amer. Min., 1939, **24**, 194).—Hopeite has a_0 10·64, b_0 18·32, c_0 5·03 A., and 4 $[Zn_3(PO_4)_2,4H_2O]$ per unit cell. L. S. T.

Monticellite rock from Crestmore, California. A. F. ROGERS (Amer. Min., 1939, **24**, 192).—Crestmore is probably the most prominent locality for the rare mineral monticellite, $CaMgSiO_4$. L. S. T.

European colloform ores of Mississippi Valley type. C. H. BEHRE, jun. (Amer. Min., 1939, **24**, 181).—Pb–Zn ores of this type in certain districts of western Europe, like those of the upper Mississippi Valley in the United States, show distinctive mineralogic features. In calcareous country rock the ore and gangue minerals are typically blende, galena, pyrite and marcasite, barite, fluorite, calcite, dolomite, ankerite, and quartz; the colloform masses of wurtzitic blende, banded alternately with the other sulphides, are especially characteristic. In districts where the country rock is non-calcareous, these types are unknown; the gangue minerals change, and the colloidal appearance of the ore minerals is absent. The $Ca^{\cdot\cdot}$ in the gangue minerals and the colloform structure of the ores are due probably to the influence of the calcareous country rock. L. S. T.

Graphic granite. E. E. WAHLSTROM (Amer. Min., 1939, **24**, 681—698).—The graphic pattern is due to the growth of tapering cross-striated pencils of quartz (I) in or with felspar (II). The (I) shows no const. orientation with respect to the (II). Selective replacement of the microcline in graphic granite forms graphic intergrowths of pairs of minerals such as (I) and albite, (I) and muscovite, etc. Graphic intergrowths of (I) with tourmaline, hornblende, garnet, etc. are produced either by partial replacement of (I) or by the action of SiO_2-rich solutions on older minerals. Graphic granite probably forms by partial replacement of (II), or by the simultaneous growth of (I) and (II). L. S. T.

Polymorphism of the micas, with optical measurements. S. B. HENDRICKS [with M. E. JEFFERSON] (Amer. Min., 1939, **24**, 729—771).—*X*-Ray diffraction patterns of single crystals of >100 specimens of micas have been taken, and crystal structure analyses for the various polymorphic modifications carried out. The 7 different cryst. modifications discovered have the following consts.: single-layer monoclinic hemihedral (45), $2[R_3(Al,Si)_4O_{10}(OH,F)_2K]$, where R is $Mg^{\cdot\cdot}$, $Fe^{\cdot\cdot}$, $Fe^{\cdot\cdot\cdot}$, $Li^{\cdot}$, $Ti^{\cdot\cdot\cdot\cdot}$, etc., *a* 5·3, *b* 9·2, *c* 10·2 A., β 100°, space-group C_s^3—Cm; two layer monoclinic holohedral, muscovite type, (21), $4[Al,R)_2(Al,Si)_4O_{10}(OH,F)_2K]$, *a* 5·2, *b* 9·0, *c* 20·0 A., β 95° 30′, space-group C_{2h}^6—$C2/c$; two-layer monoclinic holohedral, octophyllite type (5), $4[R_3(Al,Si)_4O_{10}(OH,F)_2K]$, *a* 5·3, *b* 9·2, *c* 20·2 A., β 95°, space-group C_{2h}^6—$C2/c$; three-layer rhombohedral enantiomorphic hemihedral (8), $3[R_3(Al,Si)_4O_{10}(OH,F)_2K]$, *a* 5·3, *c* 30·0 A., space-group D_3^3—$C3_1$ 12 or D_3^5—$C3_2$ 12; six-layer monoclinic hemihedral, lepidolite type (3), $12[R_3(Al,Si)_4O_{10}(OH,F)_2K]$, *a* 5·3, *b* 9·2, *c* 60·0 A., β 90°, space-group C_s^4—Cc; six layer triclinic holohedral (3), $6[R_3(Al,Si)_4O_{10}(OH,F)_2K]$, *a* 5·3, *b* 5·3, *c* 60·0 A., α 90°, β 90°, γ 120°, space-group C_i^1—$P\bar{1}$; and twenty-four-layer triclinic holohedral (1), $24[R_3(Al,Si)_4O_{10}(OH,F)_2]K$, *a* 5·3, *b* 5·3, *c* 240·0 A., α 90°, β 90°, γ 120°, space-group C_i^1—$P\bar{1}$. The frequencies of occurrence are given in parentheses. At. co-ordinates, optical properties, and localities are tabulated, and Weissenberg photographs and the sequences of layers of the types are given. Mixtures (13) of the various structures were found. Explanations for the diffuse scattering of *X*-rays in some crystal zones and for Winchell's grouping of micas (A., 1936, 308) are advanced. L. S. T.

Dolomitisation in glacio-lacustrine silts of Lake Agassiz. G. D. SHERMAN and G. A. THIEL (Bull. Geol. Soc. Amer., 1939, **50**, 1535—1551).—Fine-grained lacustrine silts 25—75 ft. thick cover hundreds of sq. miles on the floor of Lake Agassiz, and in many localities an enriched dolomitic zone 1—10 ft. thick occurs in the silts at 1—3 ft. below the surface. The dolomitic bodies are probably not a product of negative enrichment formed by leaching of $CaCO_3$. The ground waters contain high % of Na and Mg salts. Gypsum (I) nodules and crystals are found with and below the dolomite. A replacement of Ca by Mg and pptn. of Ca as (I) are indicated. Chemical analyses of waters from the Lake Agassiz region and numerous determinations of CO_2 in the dolomites are recorded. L. S. T.

Crystal structure of gudmundite. M. J. BUERGER (Amer. Min., 1939, **24**, 183—184).—Gudmundite has *a* 6·02, *b* 5·93, *c* 6·02, β 67° 52′, $\rho_{calc.}$ 6·93, 4 FeSbS per unit cell; space-group C_{2h}^5. At. positions are given, and the interat. distances confirm earlier work on the abnormal interat. distances in members of the marcasite, loellingite, and arsenopyrite groups. L. S. T.

Composition and optics of copiapite. L. G. BERRY (Amer. Min., 1939, **24**, 182).—*X*-Ray and ρ measurements [M. A. PEACOCK] on copiapite (I) from Chuquicamata, Chile, give triclinic structural elements and the cell formula $X(OH)_2Fe_4^{III}(SO_4)_6,nH_2O$, where *X* represents several bases amounting to 1 equiv. of O. Reduction of numerous analyses of (I) to 6 S instead of the usual 5 confirms this formula, and shows that *X* may be $2/3R^{III}$ (Fe^{III}, Al), R^{II} (Fe^{II}, Mn, Cu, Zn, Ca, or Mg), or $2R^{I}$ (Na, K), and the max. val. of *n* is 20. When *X* is mainly Fe^{III}, Fe^{II}, or Mg, the names ferri-, ferro-, and magnesio-copiapite, respectively, are proposed. L. S. T.

Crystallography of copiapite. M. A. PEACOCK (Amer. Min., 1939, **24**, 191).—*X*-Ray photographs [M. J. BUERGER] of copiapite (I) from Chuquicamata, Chile, give a_0 7·33, b_0 18·15, c_0 7·27 A., β 101° 30′, γ 99° 23½′, $a_0 : b_0 : c_0 = 0·404 : 1 : 0·401$, which differ from the vals. obtained (Ungemach, A., 1935, 1100) for (I) from Sierra Gorda, Chile. These and other variations in the crystallographic elements of (I) can be explained by variations in chemical composition and optics (cf. preceding abstract). L. S. T.

Minerals of Eight Mile Park, Colorado. K. K. LANDES (Amer. Min., 1939, **24**, 188).—Granite pegmatites, three of which have been exploited for felspar, are abundant in the pre-Cambrian cryst. rock. The dominant minerals in the pegmatites are microcline and quartz, with abundant muscovite. Large crystals of beryl are common. Albite is subordinate; pink tourmaline, black lepidolite, and black tourmaline with milky quartz are also present. L. S. T.

Overite, a new mineral from Fairfield, Utah. E. S. LARSEN, 3rd (Amer. Min., 1939, **24**, 188).—Overite is orthorhombic and occurs as pale green to colourless prismatic crystals; hardness 4, ρ 2·53, α 1·568, β 1·574, γ 1·580 (all ±0·002), $a : b : c = 0·7839 : 1 : 0·3794$ (morphological), a_0 14·62, b_0 18·68, c_0 7·08 A., v_0 1936 A.^{3}; unit cell $2[Ca_3Al_6(PO_4)_8,20H_2O]$. L. S. T.

Ceramic clay in Hawaii. C. K. WENTWORTH, R. C. WELLS, and V. T. ALLEN (Amer. Min., 1940, **25**, 1—33).—The occurrence of the clays at Oahu, Molokai, Maui, Kauai, and Hawaii, and production methods are described. Ceramic properties and chemical analyses of the Oahu clay are recorded. This clay is a mixture of illite, with small amounts of kaolinite, plagioclase, and quartz, and an unusually high % (15) of TiO_2, probably present as ilmenite and leucoxene. The origin of the clay is discussed. L. S. T.

Soil exchange cations and their geochemistry. I. D. SEDLETZKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 207—209).—The principal exchange cations in soil are K, Na, Ca, Mg, and H. These elements in eruptive rocks become fixed in the lattices of argillaceous minerals during soil formation. The composition of the three large groups of minerals in soil colloids, Mg and Ca aluminosilicates (*e.g.*, montmorillonite), H minerals (*e.g.*, kaolinite), and Na and K minerals (*e.g.*, muscovite), explains the prevalence of these exchange cations. Other cations of eruptive rocks fail to take part in building up newly formed secondary minerals and so become removed from soils. The character of the migration of elements in soils depends on definite geochemical conditions. F. H.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

JUNE, 1940.

Band spectra of sulphur and selenium excited in ignition tubes containing mixtures of hydrogen and oxygen with traces of sulphuric acid and selenium. M. Miyanisi (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 79—84).—Band spectra of S and Se appear in $2H_2 + O_2$ flames containing small amounts of H_2SO_4 or Se. In presence of H_2O vapour in discharge tubes the S and Se bands are enhanced in the neighbourhood of the OH bands 2′—1″, 1′—0″, 1′—2″, and 0′—1″. The effect is ascribed to excited OH. L. J. J.

First spectrum of tin. W. F. Meggers (J. Res. Nat. Bur. Stand., 1940, **24**, 153—173).—Data are recorded for λ and relative intensity of 341 lines in the Sn I spectrum between 1697·59 and 12536·5 A. photographically, and 37 up to 2473·2 A. radiometrically. Assignment of energy levels for four $5p^2$—$5pns$ series gives an abs. val. 59,155 cm.$^{-1}$ for the ground level, and a val. 7·297 v. for the principal ionisation potential. L. J. J.

Luminescence spectra of the night sky in the ultra-violet region. P. P. Dobronravin and I. A. Chvostikov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 233—237).—Solar short-wave spectra have been photographed for day, night, and twilight using a spectrograph fitted with a slit-reducing attachment. Three series of photographs have been obtained which show that the intensity of the ultra-violet light in the night-sky spectra is > those of day and twilight. This may be due to conditions favourable to the dispersion of short-wave solar radiation in the outer atm. layers. W. R. A.

Excitation of atoms in a gas discharge. V. Fabrikant (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 224—228).—Mathematical. W. R. A.

Interaction of atomic energy levels. II. T. S. Subbaraya, K. Seshadri, and N. A. N. Rao (Current Sci., 1940, **9**, 14—18; cf. A., 1940, I, 88).—The spectra of Hg, Cd, and Hg–Cd mixture have been studied. The variations in intensity of the lines of the elements in admixture are noted, and explanations suggested, and the appearance of lines not apparent in the spectra of Cd and Hg separately has been observed in Hg–Cd. The Hg resonance line 2537 A. shows complete self-reversal in Hg but no reversal in Hg–Cd. The 2540 A. line is present in Hg and Hg–Cd but not in Hg–Zn. Similarly the ZnH bands in Zn appear in Hg–Zn, whilst the CdH bands, although present in Cd, are absent in Cd–Hg. No interaction has been found between some levels of Hg and Cd which are close to each other, *e.g.*, 6^1P_1 of Hg and 6^1S_0 of Cd. W. R. A.

Effects of chemical combination on the $K\beta$ lines of chlorine. H. Tazaki and M. Huzita (J. Sci. Hirosima Univ., 1940, **A**, **10**, 73—75).—The position and strength of the weak non-diagram lines observed by Tazaki (A., 1936, 1311) in the $K\beta$ spectrum of Cl have been investigated for $MgCl_2$, $AlCl_3$, and $KClO_3$ on an Al anticathode, $CaCl_2$ and CuCl on Al and Cu anticathodes, and $BaCl_2$, $KClO_4$, and $NaClO_3$ on a Cu anticathode. O. D. S.

Thermal ionisation of barium. B. N. Srivastava (Proc. Roy. Soc., 1940, **A**, **175**, 26—36).—A method for the study of thermal ionisation of gases is described and is applied to Ba vapour. The results are in agreement with theory and also support the explanation usually given for the fact that Ba is completely ionised in the sun although Na with lower ionisation potential is not. G. D. P.

Rôle of ionisation by positive ions in spark breakdown. R. N. Varney, L. B. Loeb, W. R. Haseltine (Phil. Mag., 1940, [vii], **29**, 379—390; cf. Townsend, A., 1939, I, 395).—Theoretical. Townsend's theory (*loc. cit.*) of ionisation by positive ions is erroneous. The probability of such ionisation under sparking conditions is negligible. O. D. S.

Groups of protons emitted during the bombardment of hydrogenated substances by polonium α-rays. II. T. San-Tsiang (J. Phys. Radium, 1940, **1**, 103—111).—In the diffusion of α-particles by the H nucleus, the relation between the effective experimental cross-section and that calc. from the Rutherford formula varies periodically as a function of the energy of the α-particles. The angular variations of the effective section show that the orbital moments, $l = 0$ and $l = 1$, are equally important in diffusion experiments. ^5_2He is stable, the upper limit of its mass being 5·0124, and ^5_3Li is unstable. The results on anomalous diffusion are discussed from the viewpoint of the theories of Mott, Beck, and Bethe. W. R. A.

β-Ray spectrum of radium-*E*. G. J. Neary (Proc. Roy. Soc., 1940, **A**, **175**, 71—87).—The spectrum was studied by means of a magnetic spectrograph of special design to facilitate observation at low energies. The energy curve has a max. at 150 ke.v. and an end point at 1·17 Me.v. with a mean energy of 340 ke.v. in agreement with calorimetric observations. G. D. P.

Weak radioactive substance. R. De (Indian J. Physics, 1939, **13**, 407—409).—Monazite contains two constituents possessing similar chemical properties. One of these constituents is weakly radioactive and appears to emit α-rays; it gives some of the tests of Po. Its average life is $\gg 10^{20}$ years. W. R. A.

Volcanism and nuclear chemistry. I. M. Noetzlin (J. Phys. Radium, 1940, [viii], 1, 90—98).—Mathematical. Nuclear chain reactions on a macroscopic scale, produced by neutron bombardment, are studied and the conditions and the stability of a mixed material containing a neutron source are formulated. The application of the theory to the explanation of volcanic phenomena is outlined. W. R. A.

Neutron sources consisting of a radium salt mixed with beryllium. Z. Ollano (Nuovo Cim., 1939, **16**, 456—458; cf. A., 1939, I, 293).—The lower yield of a neutron source consisting of a Ra salt mixed with Be compared with that of a Rn + Be source is due to poor distribution of the Ra salt in the Be. O. J. W.

β-Radioactivities of rhenium. F. Yamasaki and K. Sinma (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 10—16).—When metallic Re powder was bombarded with neutrons from Be + D, retarded by paraffin, two strongly active substances were produced with half-life 16±1 and 90±2 hr., respectively. These were identified by chemical separation as ^{188}Re and ^{186}Re. The upper limits of energy are 1·2 Me.v. for ^{186}Re and 2·5 Me.v. for ^{188}Re. Both emit β- and γ-radiations. A. J. M.

Theory of cosmic-ray showers. I. Furry model and fluctuation problem. A. Nordsieck, W. E. Lamb, jun., and G. E. Uhlenbeck (Physica, 1940, **7**, 344—360).—A general method, based on Furry's treatment (A., 1937, I, 591), is developed for calculating the fluctuation in the no. of particles after penetration of any thickness of matter. L. J. J.

Penetrating cosmic-ray showers. L. Jánossy and P. Ingleby (Nature, 1940, **145**, 511—512).—Counter experiments affording evidence of the occurrence at sea-level of a small no. of penetrating showers different from cascades or knock-on showers are described. Some of the observed showers may be due to the creation of mesons in the Pb absorber. L. S. T.

Secondary radiation of cosmic rays. G. Cocconi and V. Tongiorgi (Nuovo Cim., 1939, **16**, 447—455).—Measurements of the angular distribution of very soft, soft, and hard showers show that small angles do not prevail in the last-named. The secondary radiations produced by the hard component in various substances are the more numerous the lower is the at. no. of the substance which produces them. O. J. W.

Twelve-hour period of mesotron intensity and height of origin of mesotrons. A. Ehmert (Naturwiss., 1940, **28**, 28—29).—A crit. review of results obtained for the amplitude of oscillation of the isobar responsible for the 12-hr. period of mesotron intensity. A. J. M.

Photon component of cosmic radiation and its absorption coefficient. L. Jánossy and B. Rossi (Proc. Roy. Soc., 1940, **A**, **175**, 88—100).—The method described for the study of cosmic-ray photons consists in the detection of the electrons generated by photons in a metal plate. The transition effect of showers in Pb was measured and good agreement with theory was obtained. Absorption coeffs. of cosmic-ray photons in Pb, Fe, and Al were measured. G. D. P.

Evaluation of *e*, *h*, *m*. C. G. Darwin (Proc. Physical Soc., 1940, **52**, 202—209).—A simplified treatment of Du Mond's discussion of small discrepancies (cf. A., 1939, I, 507), based on consideration of the logarithms of the quantities concerned. N. M. B.

Velocity of propagation of light *in vacuo* in a transverse magnetic field. C. J. Banwell and C. C. Farr (Proc. Roy. Soc., 1940, **A**, **175**, 1—25).—The investigation was carried out by means of an interferometer of the Michelson type using a field of 20,000 oersted. The effect is <1 part in 5×10^8. G. D. P.

Temperature of electrons in [an] electric field and calculation of Townsend's α. A. A. Zaitzev (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 229—232).—Mathematical. The temp. of electrons moving in a homogeneous electric field has been calc. from at. consts. W. R. A.

Theory of the deuteron. J. Solomon (Compt. rend., 1940, **210**, 477—478).—The extent to which the ^3D state occurs in the fundamental level of the deuteron ($^3S + {}^3D$) is $\not>$40%. The photo-electric effect for the deuteron should deviate considerably from Bethe and Peierls' theory, and the magnetic moments should not be additive. A. J. E. W.

Theory of the electric charge and the quantum theory. I. H. T. Flint (Phil. Mag., 1940, [vii], **29**, 330—343).—Mathematical. O. D. S.

Origin of colour in paramagnetic salts and solutions. D. M. Bose (Indian J. Physics, 1939, **13**, Part VI, Suppl., 18 pp.).—An address. W. R. A.

Absorption spectra of organic substances in phosphoric and sulphuric acids at various concentrations. F. Bandow (Z. physikal. Chem., 1939, **45**, **B**, 156—164).—The absorption spectra of several org. substances (BzOH, PhCHO, furfuraldehyde, anisaldehyde) in H_2SO_4 from 2200 to 5600 A. are displaced to longer λλ with respect to the corresponding spectra of these compounds in non-charring solvents (H_2O, EtOH). The displacement, however, appears for a narrow concn. range only (~70—80 wt.-% H_2SO_4). The data are compared with the various spectra in H_3PO_4, and differences are explained on the basis of the H_2O-attracting power of H_2SO_4. W. R. A.

Absorption of light by ionic crystals in the ultra-violet. L. M. Schamovski (J. Phys. Chem. Russ., 1939, **13**, 835—839).—Vals. for the long-λ limit of absorption of heteropolar crystals calc. by means of the equations previously derived (A., 1937, I, 11) agree with existing directly determined vals. The absorption spectra of mixed crystals exhibit absorption bands of both salts. R. C.

Absorption spectra of complex compounds. I. A. V. Babaeva (Ann. Sect. Platine, 1939, No. 16, 87—107).—The ultra-violet absorption spectra of 21 Pt complexes were studied. All gave a max. at 285 mμ., and all complexes with acidic substituents (Cl, NO_2) in the inner sphere exhibited a second max.

at 335 mμ. Complexes not containing basic radicals (NH_3, NH_2OH) gave a third max. at 400—410 mμ. The ultra-violet spectrum is not affected by *cis–trans*-isomerism. R. T.

Vibrational analysis of the absorption spectrum of furan in the Schumann region. (MISS) L. W. PICKETT (J. Chem. Physics, 1940, 8, 293—297).—Furan vapour has three band systems between 2200 and 1550 A. One region consists of bands with sharply-defined max. with a 0–0 band at 52,230 cm.$^{-1}$ and 21 other bands, including three prominent max. which correspond with three totally symmetrical νν of the excited mol. of 1395, 848, and 1068 cm.$^{-1}$ These bands are assigned to combination- and overtones of four fundamental νν. A second region has three broad bands with separations of 1215 and 1095 cm.$^{-1}$, whilst the third region begins so near the point at which the H_2 spectrum is discontinuous that the bands cannot easily be measured. This third region may represent the predicted four $N \rightarrow V$ transitions with max. ~58,500 cm.$^{-1}$ (found, 59,580 cm.$^{-1}$) and total f val. 0·3. W. R. A.

Absorption spectra. III. Spectra of anthracene, octahydroanthracene, and perhydroanthracene in the ultra-violet. P. M. HEERTJES and H. I. WATERMAN (Bull. Soc. chim., 1940, [v], 7, 187—191; cf. A., 1939, I, 385).—The absorption spectra of anthracene (I), octahydroanthracene (II), and of a mixture of hydroanthracenes have been measured over the λ range 2200—4000 A. The strong absorption band of (I) around 2520 A. and the bands between 3100 and 3800 A. disappear on hydrogenation. The absorption spectrum of (II) resembles that of an alkylbenzene, but with the bands displaced towards higher λλ. Comparison with the spectra of PhBu^{a}, tetrahydronaphthalene, and *m*-xylene supports Schroeter's view (A., 1925, i, 128) that (II) is *s*-bistetramethylenebenzene. J. W. S.

Spectral and physico-chemical properties of colchicine. H. SCHUHLER (Compt. rend., 1940, 210, 490—493).—Vals. of pK of 1·8, 7·2, and 10·3 are obtained by electrometric titration of 2×10^{-5}% colchicine (cf. Kolthoff, A., 1926, 125). Beer's law applies to 2×10^{-4} to 2×10^{-5}N. solutions for λ 2600—3200 A. at const. p_H. Between p_H 3 and 7 there is little change in the spectrum, but about p_H 1 the absorption bands are displaced and altered in intensity. J. L. D.

Absorption spectra of liquid hydrogen fluoride and of its aqueous solution in the region 8000—11,000 A. A. L. WAHRHAFTIG (J. Chem. Physics, 1940, 8, 349—350).—The absorption spectra of liquid HF and of 25% and 50% aq. HF have been investigated between 8000 and 11,000 A. Anhyd. liquid HF has an absorption band (max. 9940±75 A. at 19°, 10,380 A. at −75°) very similar to the H_2O band at 9722 A. The third harmonic band of unassociated HF gas is at 8790 A. (A., 1936, 406) indicating a frequency decrease of ~1320 cm.$^{-1}$ in passing from the gaseous to the liquid phase. This diminution in frequency, attributed to the formation of H bonds of the type F—H···F, is ≫ the corresponding decrease due to O—H···O H bonds. For the aq. solutions no apparent difference exists between their spectra and those of H_2O. W. R. A.

Effect of temperature on the Raman spectrum of quartz. T. M. K. NEDUNGADI (Proc. Indian Acad. Sci., 1940, 11, A, 86—95).—Fifteen fundamental internal vibration frequencies of quartz are recorded and all show a broadening and shift to lower νν as temp. is raised from liquid air temp. to 530°. One frequency (207 cm.$^{-1}$) broadens very markedly but unsymmetrically at high temp. and disappears as the temp. approaches 575° (temp. of $\alpha \rightarrow \beta$ transformation). The behaviour of this line is paralleled by the behaviour of other physical properties, *e.g.*, thermal expansion, piezo-electric activity, and elastic moduli, and it is concluded that this vibration is chiefly responsible for these changes and for the transition. With unpolarised incident light three lines (263, 794, and 805 cm.$^{-1}$) are not found in the light scattered longitudinally along the optic axis. W. R. A.

Raman effect in arsenates and heat of dissociation of As–O. S. M. MITRA (Indian J. Physics, 1939, 13, 391—395).—The Raman spectra of aq. Na_3AsO_4 and K_3AsO_4 have been examined. The AsO_4''' ion is characterised by four νν (349, 463, 837, and 878 cm.$^{-1}$) and from the close resemblance to the ClO_4' and SO_4'' ions it is concluded that the AsO_4''' ion has a tetrahedral structure. From the Raman νν the binding energy of the As–O link has been calc. and a val. for the heat of dissociation of this link has been deduced (71 kg.-cal.; cf. val. from thermal data, 110·1 kg.-cal.). W. R. A.

Raman spectra of aqueous solutions of gaseous hydrogen chloride. (MLLE.) L. OCHS, J. GUÉRON, and M. MAGAT (J. Phys. Radium, 1940, [viii], 1, 85—89).—Aq. solutions of HCl up to 19N. have been investigated at room temp. In the more conc. solutions (>9N.) a band due to non-ionised HCl is found. The influence of HCl on the Raman spectrum of H_2O is discussed, particularly a band due to association of HCl and H_2O in a quasi-cryst. structure. The theory of the hydrated proton $[H_3O]^+$ is discussed in the light of these results. W. R. A.

Raman effect. CVIII. Spectral transformations $XY_4 \rightarrow XZ_4$: correction. K. W. F. KOHLRAUSCH and J. WAGNER. **CIX. Pentaerythritol and related molecules.** O. BALLAUS and J. WAGNER (Z. physikal. Chem., 1939, 45, B, 93—100, 165—174).—CVIII. A reconsideration of previous results (A., 1935, 681; A., 1938, I, 386) from a new viewpoint with particular reference to the transformations $CH_4 \rightarrow CCl_4$, $CH_4 \rightarrow CBr_4$, $CHCl_3 \rightarrow CXCl_3 \rightarrow CCl_3$ (X = D, F, Cl, Br), and $CCl_4 \rightarrow CBr_4$.

CIX. Raman spectra of crystal powders of $C(CH_2X)_4$ (X = OH, Cl, Br, I), of molten $C(CH_2Cl)_4$, and of liquid $C(CH_2{\cdot}OMe)_4$ are recorded and discussed. W. R. A.

Raman spectra of coumarins and chromones. (MISS) A. MOOKERJEE and J. GUPTA (Indian J. Physics, 1939, 13, 439—444).—Raman spectra of coumarin (solid, in $CHCl_3$, in MeOH), chromone (molten, in $CHCl_3$, in MeOH), and of $CHCl_3$ solutions of 7-hydroxy-3 : 4-dimethylcoumarin, 7-hydroxy-2 : 3-dimethylchromone, and β-methylumbelliferone Me

ether are recorded and discussed with reference to shifts in the C:O frequency. W. R. A.

Raman spectrum of substituted ketimines; isomerism of these bases. R. CANTAREL (Compt. rend., 1940, **210**, 480—483).—The C:N ν in Ph_2 ketimine is 1649 cm.$^{-1}$; the more intense C:O ν in $COPh_2$ is 1658 cm.$^{-1}$ Attachment of Ph groups to C:N in benzhydrylidene-benzylamine and -benzhydrylamine (I) reduces its ν to 1622 and 1618 cm.$^{-1}$, respectively, and also reduces the intensity. In benzylidene-benzhydrylamine (II), the isomerisation product of (I), the C:N ν is raised to 1636 cm.$^{-1}$ The CPh_2: grouping gives lines at ~1274 and 1490 cm.$^{-1}$; the latter is also given at much lower intensity by CHPh: in (II). Numerous other unassigned Raman νν are given for the compounds named and $CHPh_2\cdot NH_2$. A. J. E. W.

Raman spectra of cholesterol and cholic acid. C. SANNIÉ (Compt. rend., 1940, **210**, 400—402).—Data for the ν range 500—3000 cm.$^{-1}$ are given, and comparison is made with carvomenthone (I) and carvomenthene (II). Cholesterol (20 g. in 100 c.c. of CCl_4; 27 bands) gives numerous weak bands at 800—1300 cm.$^{-1}$, which are ascribed to large saturated rings; a band at 1135 cm.$^{-1}$ (C_5–C_{10} chain?) is somewhat stronger. At 1300—1500 cm.$^{-1}$ the spectrum resembles that of (I) with the bands displaced 20—25 cm.$^{-1}$ towards higher νν. A band at 1670 cm.$^{-1}$ indicates a double linking attached at one end to a quaternary C [as in (II)]. The spectrum of 30% aq. Na cholate (17 bands) shows little resemblance to those of cholesterol, (I), or (II), and the bands are broad and diffuse. A. J. E. W.

Influence of foreign substances on the absorption of dyes in solution. S. MITRA (Indian J. Physics, 1940, **13**, 397—405).—An attempt has been made to determine whether the phenomena of quenching of the fluorescence of dyes in solution is due to deactivating collisions between active dye mols. and the foreign substance or to a gradual "complex formation" between the dye mols. and the quencher. Quenching of fluorescence of fluorescein, rhodamine B, and eosin by KI has been examined. W. R. A.

Properties of oxide-coated cathodes. I. J. P. BLEWETT (J. Appl. Physics, 1939, **10**, 668—679).—A review of oxide cathode technique and the thermal and electrical properties of alkaline-earth oxides. O. D. S.

Photoconductivity of semi-conducting layers composed of some heavy-metal sulphide or selenide. I. Relation between spectral sensitivity and light absorption in the photoconducting layer composed of cadmium selenide and the microscopic examinations of its structure in relation to its photoconductivity. II. Microscopic examinations of the semi-conducting layer composed mainly of thallous sulphide in relation to its photoconductivity. C. ASAI (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 1—3, 4—5).—I. The max. of the spectral sensitivity of a Cd–Se photoconducting layer is displaced towards longer λλ compared with the corresponding absorption band. Microscopical examination reveals a close connexion between the growth of crystal grains in the layer and its photoconductivity.

II. The larger are the crystal grains in a Tl–S semiconducting layer, the greater is its sensitivity, and the less its dark resistance. A. J. M.

Conductivity of metals. K. ARIYAMA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 1—9).—Theoretical. A. J. M.

Corpuscular theory of electrical conductivity of metals. T. V. IONESCU (Compt. rend., 1940, **210**, 502—504).—Previous theory (A., 1940, I, 139) is extended; the mobility of electrons in a cubic ionic lattice is considered, and vals. are deduced for the thermal conductivities of Cu, Al, Au, and Na, at 20—373° K. A. J. E. W.

Dielectric constant of ionised air. III. F. RAHMAN and S. R. KHASTGIR (Phil. Mag., 1940, [vii], **29**, 344—352; cf. A., 1938, I, 387).—Measurements of the electron density and temp., by the Langmuir probe method, and of the dielectric const., ε, of air in a discharge tube have been carried out simultaneously at a series of pressures and currents. Results are consistent with the theory that the anomalous increase in ε to vals. >1 with increasing current is due to the formation of a positive ion sheath on the walls of the tube. O. D. S.

Dielectric constant of diamond. L. G. GROVES and A. E. MARTIN (Trans. Faraday Soc., 1940, **36**, 575—581).—The dielectric const. of diamond has been determined by two methods. Apparatus and procedure are described. The vals. obtained by the two methods are 5·26 and 5·35, the latter being preferred. ε is the same for the two types of diamond (cf. A., 1934, 583). F. L. U.

Dielectric constant and electrical conductivity of gases and vapours ionised by *X*-rays at ultra-high radio frequency. S. R. KHASTGIR and F. RAHMAN (Phil. Mag., 1940, [vii], **29**, 353—366).—A change in the capacity at ultra-high radio frequency, λ 460 and 480 cm., of a condenser filled with air, SO_2, A, or a mixture of the vapours of MeI and EtI, on ionisation of the gas by *X*-rays is ascribed to a decrease in the dielectric const. of the gas. This decrease may be explained by supposing that ejected photo-electrons remain free for an appreciable time after ionisation. The high-frequency conductivity of A and SO_2 ionised by *X*-rays is ~10^4 or 10^5 e.s.u. and decreases with increase in pressure. O. D. S.

Ionic character and dipole moments. F. T. WALL (J. Amer. Chem. Soc., 1940, **62**, 800—803).—Mathematical. A theory of dipole moments of diat. mols. is developed and shows that the sum of the dipole moments of two states produced by resonance is the same as the sum of the dipole moments of the original states. W. R. A.

Dipole moment, induction, and resonance in tetra-, penta-, and hexa-substituted benzenes. C. P. SMYTH and G. L. LEWIS (J. Amer. Chem. Soc., 1940, **62**, 721—727).—Vals. of μ for C_6H_6 solutions at 25° are given for C_6Me_5Cl, C_6MeCl_5, C_6EtCl_5, C_6HCl_5, 1 : 2 : 3 : 4-$C_6H_2Cl_4$, trichloromesitylene, dichlorodurene, 1 : 2 : 4 : 6-$C_6H_2MeCl_3$, trichloro-ψ-cum-

ene, tetrachloro-, 4 : 5-dichloro-, and 3 : 4 : 5-trichloro-*o*-xylene, dichloro- and dinitro-prehnitene. Observed and calc. vals. are in agreement when allowance for inductive effects is made. The effects of resonance of Me and Cl groups on the ring have not been definitely established. W. R. A.

Optical activity and chemical structure in tartaric acid. Influence of substituent and solvent effect.—See A., 1940, II, 203.

Optical anisotropy of molecular crystals. I. NITTA (Sci. Papers. Inst. Phys. Chim. Res. Tokyo, 1940, **37**, 114—130).—The double refraction of a mol. crystal with a body-centred tetragonal lattice can be resolved into terms dependent on the anisotropy of the mol. and the cryst. parameters. Mol. polarisabilities calc. from *X*-ray and optical data on this basis are in agreement with the accepted mol. structure for $C(CH_2{\cdot}OH)_4$, $C(CH_2{\cdot}O{\cdot}NO_2)_4$, and $C(CH_2{\cdot}OAc)_4$. The temp. coeff. calc. for the double refraction of $C(CH_2{\cdot}OH)_4$ is in agreement with the observed val. L. J. J.

Constitution of sulphon-amides and -anilides.—See A., 1940, II, 214.

Polymerisation of anthracene to dianthracene from the magnetic standpoint. (A) J. FARQUHARSON and M. V. C. SASTRI. (B) S. S. BHATNAGAR, P. L. KAPUR, and (MISS) G. KAUR (Current Sci., 1940, **9**, 135—136, 136).—(A) The correction factor (λ) for the ring formed in the polymerisation of anthracene as determined by Bhatnagar *et al.* (A., 1940, I, 153) differs from that established by Farquharson and Sastri (A., 1938, I, 20) for a four-membered ring. The bridging group in dianthracene is shown to be an eight-membered puckered ring.

(B) The authors' "bridged four-membered ring" is identical with the "eight-membered puckered ring" of the preceding abstract. F. R. G.

Modern quantum mechanics and the benzene problem. VI. G. ELSEN (Chem. Weekblad, 1940, **37**, 199—209; cf. A., 1940, I, 60, 99).—The review is concluded with a discussion of resonance between double and single C–C linkings. D. R. D.

Continuous passive spectra. V. K. ARKADIEV and O. I. VELETSKAJA (Bull. Acad. Sci. U.R.S.S., Cl. Sci. Tech., 1938, **2**, 55—70).—Equations and curves of dispersion and absorption are given for media of large and small inner friction, based on the assumption that the time consts. of the electric and magnetic centres in the media are spread over a certain range in the logarithmic frequency scale. As examples the spectral properties of soft Fe (transformer shrouding) and glycerol are given. L. G. G.

Bond strength and potential energy relationships in acetylene. H. HENKIN and M. BURTON (J. Chem. Physics, 1940, **8**, 297—300).—Four divergent vals. for the C⋮C bond strength are reviewed. From the spectroscopic val. for the heat of formation of free C–H and the val. of 125·1 kg.-cal. for the heat of sublimation of graphite, the bond strength of C⋮C is ~137·9 kg.-cal. This is used in studying the potential energy levels of C_2H_2 and gives vals. in agreement with experimental data on the spectrum of C_2H_2. W. R. A.

Surface tension of liquid deuterium. A. VAN ITTERBEEK (Physica, 1940, **7**, 325—328).—The ratio of the surface tension of D_2 to that of H_2, measured by the capillary-rise method, is 1·74, 1·70, and 1·67 at 20·4°, 19·4°, and 18·7° K., respectively. The ratio of the densities is const. at ~2·40. Extrapolation of surface tension vals. gives ~46° K. for the crit. temp. of D_2. L. J. J.

Epimeric alcohols of the *cyclo*hexane series. Parachor as a criterion for *cis–trans*-isomerism.—See A., 1940, II, 169.

***X*-Ray diffraction by finite and imperfect crystal lattices.** P. P. EWALD (Proc. Physical Soc., 1940, **52**, 167—174; cf. Patterson, A., 1940, I, 61).—Mathematical. A discussion of the Fourier transform of a crystal and its relation to diffraction properties. N. M. B.

Tables of extinction for the 230 crystallographic spatial groups. J. D. H. DONNAY and D. HARKER (Natural. Canad., 1940, **67**, 33—69; cf. A., 1937, I, 171).—Tables correlate the morphological aspects of the crystal with the spatial groups. O. D. S.

Consistent notation for point positions in space-group. L. W. MCKEEHAN (J. Chem. Physics, 1940, **8**, 346).—A new notation with six characters per point is advocated. W. R. A.

Structure of a cold-worked metal. W. L. BRAGG (Proc. Physical Soc., 1940, **52**, 105—109).—It is suggested that a cold-worked metal is in dynamical rather than statical equilibrium. The existence between crystallites produced by cold-working and distortion of boundaries similar to the films separating bubbles in a foam is proposed by analogy with the state of affairs in superlattices. N. M. B.

Crystalline structure and deformation of metals. W. A. WOOD (Proc. Physical Soc., 1940, **52**, 110—116; cf. B., 1939, 497).—A survey, based on mechanical, metallographic, and *X*-ray tests, of changes in cryst. structure of polycryst. metals and large single crystals subjected to deformation by cold-work and by static and cyclic stressing. It is shown that the grains may be dispersed into crystallites characterised by a lower limiting size depending on the metal, and that internal lattice strains, considered to be related to the process of strain-hardening, can be observed. The response of the cryst. structure depends on the manner and speed of application of stress, and it is thus possible to inhibit the dispersed crystallite formation and suppress the primitive yield point of a metal, so varying the hardness independently of the external deformation. N. M. B.

Lattice distortion in cold-worked metals. G. W. BRINDLEY (Proc. Physical Soc., 1940, **52**, 117—126; cf. A., 1939, I, 305).—Available data on intensities of *X*-ray reflexions from cold-worked metals indicate that in this respect the lattice distortion resembles a frozen heat motion. For filed powders of Cu, Ni, and Rh, the intensity effect decreases in this order. Measurements of the widths of reflexions from Cu, Ni, and Rh are discussed in relation to various theories of broadening (which is shown to increase in that order) of *X*-ray reflexions. The most satisfactory

theory is that the mean lattice parameter varies from one crystallite to another. The decrease in broadening of the reflexions with an increase in the intensity effect, and the relation of these phenomena to the cohesional properties of the metals, are briefly considered. N. M. B.

Crystal boundaries in tin. B. CHALMERS (Proc. Roy. Soc., 1940, **A, 175**, 100—110).—A method for preparing specimens of Sn consisting of two crystals of specified orientation is described. The temp. at which the crystals in such a specimen separate under tension is < the m.p. of Sn, the difference being independent of the orientation of the crystals and of impurities, provided these are $\not>$0·02%. The effect is ascribed to a boundary layer in which there is some departure from exact geometrical regularity of arrangement of the atoms. G. D. P.

Oriented overgrowths of somatoids. J. WILLEMS (Kolloid-Z., 1940, **90**, 298—301).—The oriented overgrowths of $(C_6H_4\cdot OH\text{-}p)_2$ obtained by evaporating solutions in various org. solvents on freshly cleaved surfaces of calcite (cf. A., 1939, I, 308) are explained by the analogous two-dimensional structures of the respective lattices. Photomicrographs are reproduced. F. L. U.

Molecular structure factors and their application to the solution of the structures of complex organic crystals. G. KNOTT (Proc. Physical Soc., 1940, **52**, 229—238).—The mol. structure factors or Fourier transforms of C_6H_6, Ph_2, and PhMe are derived and their application to the solution of crystal structures is illustrated by reference to $C_{10}H_8$. The transform of a complex mol. can be built up from those of its component parts. N. M. B.

Constitution of sulphur nitride. (A) M. A. G. RAU. (B) N. L. PHALINKAR and B. V. BHIDE (Current Sci., 1940, **9**, 28).—A criticism and a reply (cf. A., 1940, I, 58). W. R. A.

Crystal structure of sodium peroxide octahydrate. I. Determination of density, unit cell, and possible space-groups. B. P. KOTOV (J. Phys. Chem. Russ., 1939, **13**, 829—834).—The crystals belong to the monoclinic system. The body-centred unit cell contains 4 mols. of $Na_2O_2,8H_2O$, and the periods of identity are *a* 13·49, *b* 6·45, *c* 11·49 A., with β 110° 31′. The space-group is probably either C_2^{6h} or C_i^4. R. C.

Single crystals of metaboric acid. Structure of orthorhombic metaboric acid, $HBO_2(\alpha)$. Changes of density of metaboric acid under heating. H. TAZAKI (J. Sci. Hirosima Univ., 1940, **A, 10**, 37—54, 55—61, 63—71).—I. Crystals of $HBO_2(\alpha)$ (I), orthorhombic, and $HBO_2(\beta)$ (II), monoclinic, can be obtained by heating H_3BO_3 in moist air at ~150°. Refractive indices are given. The dimensions of the unit cells (*X*-ray diffraction) are (I): *a* $8{\cdot}01_5$, *b* $9{\cdot}67_9$, *c* $6{\cdot}24_4$ A., (II): a_0 6·76, b_0 8·80, c_0 7·15 A., β 92° 40′. In each case the cell contains 12 mols. The v.p. of the systems H_3BO_3–(I)–H_2O and H_3BO_3–(II)–H_2O have been measured between 71° and 120° and 100° and 120°, respectively. The v.p. of (II) is > that of (I) in this range.

II. The detailed structure of the (I) crystal has been investigated by Fourier analysis of *X*-ray diffraction patterns.

III. *X*-Ray diffraction patterns of (I) and (II) after heating at temp. up to 250° show only lines of (I) and (II) and B_2O_3. No intermediate compound was observed. The density of H_3BO_3 at various temp. up to 200° has been measured and correlated with the loss of wt. of the specimen. Up to 100°, densities (ρ) are equal to those calc. for mixtures of H_3BO_3 and (I). Above 100° ρ correspond with mixtures of H_3BO_3, (I), and (II). At 140° ρ is that of (II). Above 140° ρ is that of mixtures of (II) and B_2O_3. The changes of ρ on heating at temp. up to 145° of (I) correspond with a continuous conversion without intermediary into B_2O_3. The ρ of B_2O_3 produced by heating (I) and (II) differ significantly. Measurements of the v.p. of (I) and (II) between 85° and 145° and 117° and 145°, respectively, have been made and are shown thermodynamically to confirm the hypothesis that B_2O_3 is produced in different forms by the decomp. of (I) and (II). O. D. S.

Dynamical theory of electron diffraction by crystal lattice. C. H. MACGILLAVRY (Physica, 1940, **7**, 329—343).—The dependence of intensity on direction of the diffracted electron bundle in Kossel and Möllenstedt's results (A., 1940, I, 101) is used to test the applicability of Bethe's theory of electron diffraction by crystals. An abs. measure of the structure factor of the reflexions can be obtained by simple geometrical measurements. L. J. J.

Molecular structure of *iso*butane. J. Y. BEACH and J. WALTER (J. Chem. Physics, 1940, **8**, 303—305).—Recalculation of the electron-diffraction theoretical scattering curve for *iso*-C_4H_{10} (A., 1938, I, 181) yields C—C distance 1·54±0·02 A. and C–C–C angle 111° 30′±2° in agreement with the data of Pauling and Brockway (A., 1937, I, 448). W. R. A.

Space-group determination of crystals of melamine. J. SHANKER, P. N. BALJEKAR, and M. PRASAD (J. Indian Chem. Soc., 1939, **16**, 671—672).—Melamine belongs to the space-group C_{2h}^5 with 4 mols. per unit cell. The cells have *a* 10·52, *b* 7·44, *c* 7·33 A. F. R. G.

***X*-Ray studies of crystallite orientation in cellulose fibres. III. Fibre structures from coagulated cellulose.** W. A. SISSON (J. Physical Chem., 1940, **44**, 513—529; cf. A., 1936, 670).—The hydrate cellulose crystallite present in fibres produced from coagulated cellulose possesses a major orientation tendency with reference to the *b* axis (axis of cellulose chains) and a minor or selective one with reference to the 101 plane. An increase in dimension of the sample in one direction causes a tendency for the *b* axes of the unit cell to orient parallel to that direction, whilst a relative decrease in dimension in one direction causes the 101 plane to orient perpendicular to that direction. In each case the degree of orientation ∝ the relative change in dimension. These phenomena are illustrated by the orientation of the 101 planes in Cellophane during shrinkage normal to the plane of the film and in rayon fibre spun without stretching. In either case simultaneous stretching produces an orientation of the *b* axis. J. W. S.

Internal strains and magnetism. R. BECKER (Proc. Physical Soc., 1940, **52**, 138—151).—Mathematical. The magnetic properties from which a numerical val. can be obtained for the internal stress are developed and co-ordinated, with detailed consideration for the 180° walls. The theoretical and experimental determination of their energy is examined. N. M. B.

Glide and hardening in metal single crystals. E. N. DA C. ANDRADE (Proc. Physical Soc., 1940, **52**, 1—7).—A survey of recent experimental work on slip in metal single crystals. Temp. has a great influence on the plastic properties, and the behaviour of different metals with the same crystal structure depends mainly on the ratio of the experimental temp. to the m.p. of the metal. Results are discussed in terms of the dislocation theory of slip. N. M. B.

Problems of plastic gliding. E. OROWAN (Proc. Physical Soc., 1940, **52**, 8—22).—A discussion of the rate of flow in metal single crystals. Flow is believed to be due to the presence of dislocations; the rate of production and movement of dislocations is examined mathematically. N. M. B.

Geometrical considerations on structural irregularities to be assumed in a crystal. J. M. BURGERS (Proc. Physical Soc., 1940, **52**, 23—33).—A description of investigations of the geometrical and mechanical properties of some types of dislocation the motion of which through the lattice has been assumed to propagate slip. It is shown that plane systems of simple dislocations can break up a crystal into Bragg-type mosaic pattern crystallites. N. M. B.

Size of a dislocation [in a crystal]. R. PEIERLS (Proc. Physical Soc., 1940, **52**, 34—37).—Calculations of the size of a dislocation and of the crit. shear stress for its motion are made. N. M. B.

Problems of the solid state. J. E. LENNARD-JONES (Proc. Physical Soc., 1940, **52**, 38—53).—A discussion of unsolved theoretical problems. One of these is the occurrence of small crystallites even in the most perfect crystals, and reasons are given for attributing such imperfections to the conditions of growth from the melt. Treatment of slip and of the melting problem is examined. Local melting may be due to slip and be a factor in producing strain-hardening. A method of evaluating the stress–strain relation outside the usual elastic limits and at temp. approaching the m.p. is given. N. M. B.

Internal friction in solids. C. ZENER (Proc. Physical Soc., 1940, **52**, 152—166).—A discussion of available data on the causes of internal friction shows that it depends in general on thermal currents arising from the inhomogeneous strains set up by the vibrations in the solid and from variations in the elastic consts. from point to point in polycryst. materials. The influence of ferromagnetism is considered. N. M. B.

Physics of stressed solids. R. W. GORANSON (J. Chem. Physics, 1940, **8**, 323—334).—By dividing the internal energy of a system into potential and kinetic functions, and examining these functions for variations of temp., hydrostatic pressure, stress, etc., a theory is evolved explaining the phenomena of deformation, plastic flow, cold-working, elastic after-working, rupture, shear, and "anomalous" effects. The effect of hydrostatic pressure on deformation and compressive strength is caused by a mechanism which consists of an elastic deformation and a deformation by a two-phase transfer, the former being a function of the potential energy, and the latter a function of the thermodynamic potential relations of the system. Expressions are given for plastic flow of polycryst. substances, and for the "brittle" potential type of rupture by combined thrust and hydrostatic pressure. W. R. A.

Supersonic velocity in gases and vapours. IX. Specific heats and dispersion of supersonic velocity in organic vapours. S. K. K. JATKAR (Indian J. Physics, 1939, **13**, 445—449).—Sp. heats of org. vapours have been calc. (i) from velocity data obtained by Railston (J. Acoust. Soc. Amer., 1939, **11**, 107) and (ii) from spectroscopic data obtained at higher temp. The two methods give results in agreement for the supersonic velocities of C_6H_6, EtOH, and Et_2O. For MeOH and CCl_4 the vals. of C_p from (i) are $<$ those from (ii), indicating the loss of vibrational sp. heats below 100 kc. per sec. The observed val. of C_p agrees with the val. calc., assuming the disappearance of deformation vibrational terms, for C_6H_6 and the disappearance of both deformational and longitudinal vibrational terms for CS_2. The C_p of $COMe_2$, $CHCl_3$, CH_2Cl_2, and EtOH from (i) are $>$ those calc. from (ii) owing to uncertain corrections for saturation. W. R. A.

Calculation of b.p. of aliphatic hydrocarbons. C. R. KINNEY (Ind. Eng. Chem., 1940, **32**, 559—562; cf. A., 1939, I, 134). F. J. G.

Physical constants of pentanol-3. F. C. WHITMORE and J. D. SURMATIS (J. Amer. Chem. Soc., 1940, **62**, 995).—Pentan-γ-ol, prepared by dehydrogenation of EtCHO with Cu catalyst, has b.p. 114·4/740 mm., n_D^{20} 1·4104, ρ_4^{20} 0·8218. W. R. A.

Measurement of the heat capacity of a small volume of liquid by the piezo-thermometric method. I. Apparatus for measuring $(\partial T/\partial P)_s$ and results for benzene and toluene. II. Coefficient of thermal expansion of benzene and of toluene measured with a new type of weight dilatometer. III. Heat capacities of benzene and toluene from 8° to b.p. J. S. BURLEW (J. Amer. Chem. Soc., 1940, **62**, 681—689, 690—695, 696—700).—I. Constructional and operational details are given of an apparatus for measuring $(\partial T/\partial P)_s$ and vals. for C_6H_6 (from 7·80° to 79·82°) and PhMe (from 7·79° to 109·83°) are recorded at 3° intervals.

II. A wt. dilatometer for measuring accurately the coeff. of thermal expansion of 5-c.c. samples is described and manipulative details are given. Vals. for C_6H_6 and PhMe at 3° intervals are given from 8° to b.p. and compared with recorded data. For PhMe $\rho^0 = 0·8854$, $\rho^{25} = 0·8622$ g. per c.c.

III. From the above data C_p for C_6H_6 and PhMe have been evaluated; the vals. agree well with existing data. There is no evidence that C_6H_6 is allotropic. W. R. A.

Specific heat of tantalum at low temperatures and the effect of small amounts of dissolved

hydrogen. K. K. Kelley (J. Chem. Physics, 1940, **8**, 316—322).—Vals. of C_p from 53° to 298° K. and of ρ_4^{25} are given for Ta and for five samples containing from 2·84 to 9·58 at.-% H, one of which (I) was prepared by pumping H_2 from a "hydrogenated" sample at 720°. Pure Ta and (I) give the same C_p vals. The C_p–T curves for "hydrogenated" samples show max. of approx. 40·7 g.-cal. per degree per g.-atom of dissolved H, for which temp. and height both increase with increase in H_2 content. The curves coincide at temp. < temp. of max. At <100° K. the higher is the amount of H_2, the lower is C_p. The entropy of Ta at 298·1° K. is 9·9±0·1 g.-cal. per degree per mol. Differences in S are attributed to differences in the no. of positions in the Ta lattice available to H at various temp. W. R. A.

Specific heats at low temperatures of tantalum oxide and tantalum carbide. K. K. Kelley (J. Amer. Chem. Soc., 1940, **62**, 818—819).—Vals. of sp. heat have been measured for Ta_2O_5 (from 53·4° to 294·2° K.) and TaC (from 54·6° to 294·5° K.). For Ta_2O_5 $S_{298·1}$ = 34·2±0·4, $\Delta G°_{298·1}$ = −453,700 and for TaC $S_{298·1}$ = 10·1±0·1. W. R. A.

Heat capacity and entropy, heats of fusion and vaporisation, and vapour pressure of methyl chloride. G. H. Messerly and J. G. Aston (J. Amer. Chem. Soc., 1940, **62**, 886—890).—The heat capacity of MeCl has been measured from 11·95° K. to the b.p. The v.p. is $\log_{10} P$ (mm.) = $-1822·60/T - 9·287119 \log_{10} T + 0·00555556T + 31·07167$; m.p., 175·44±0·05° K.; b.p. 248·943° K.; heats of fusion and vaporisation, 1537±1 and 5147±10 g.-cal. per mol.; $S_{298·94}$, and $S_{298·16}$, 54·27 and 54·31, and 55·94 and 55·98 g.-cal. per degree per mol. from thermal and spectroscopic data, respectively. W. R. A.

Resonance method for measuring the ratio of the specific heats of a gas, C_p/C_v. II. A. L. Clark and L. Katz (Canad. J. Res., 1940, **18**, **A**, 39—63).—Using the method already described (A., 1940, I, 271) the following vals. for γ at ~24° have been obtained: N_2, 1·402 at 1 atm., 1·400 at zero pressure; CO_2, 1·300 at 1 atm., 1·294 at zero pressure; H_2, 1·403 at 1 atm. and at zero pressure; A, 1·669 at 1 atm., 1·666 at zero pressure; He, 1·665 at 1 atm. and at zero pressure. In appendices, further details of theory and of apparatus are given. F. J. G.

Thermodynamical properties of real gases. M. P. Vukalovitsch and I. I. Novikov (Bull. Acad. Sci. U.R.S.S., Cl. Sci. Tech., 1939, No. 5, 33—48).—The equations obtained (A., 1940, I, 18) are similar to those of Born and Fuchs (A., 1938, I, 445). J. J. B.

Heat capacity of real gases. M. P. Vukalovitsch and I. I. Novikov (Bull. Acad. Sci. U.R.S.S., Cl. Sci. Tech., 1939, No. 6, 111—128).—The theory of the preceding abstract is applied to calculation of the heat capacity of associated gases. J. J. B.

Volatility of small particles of salt crystals with and without polymorphic change. N. Kolarov (Kolloid-Z., 1940, **90**, 294—298; cf. A., 1937, I, 453). —V.p.–particle size curves for RbCl and RbBr, which undergo no polymorphic change within the experimental temp. range, pass through a min., whilst those for Rb_2SO_4 and Cs_2SO_4, which undergo transitions at 649° and 660°, respectively, do not. F. L. U.

Thermodynamic properties of fluorochloromethanes and -ethanes: vapour pressure of three fluorochloromethanes and trifluorotrichloroethane. A. F. Benning and R. C. McHarness (Ind. Eng. Chem., 1940, **32**, 497—499).—V.p. data at 0·1—50 atm. have been determined by a static method for $CHClF_2$ (I), $CHCl_2F$ (II), CCl_3F (III), and $CCl_2F·CClF_2$ (IV). They are represented by $\log_{10} p = A - B/T - C \log_{10} T + DT$, where the coeffs., A, B, C, and D, have the following respective vals.: for (I), 25·1144, 1638·82, 8·1418, 0·0051838; for (II), 38·2974, 2367·41, 13·0295, 0·0071731; for (III), 34·8838, 2803·95, 11·7406, 0·0064249; for (IV), 29·5335, 2406·10, 9·2635, 0·0036970. The b.p. are (I), −40·80°; (II), 8·92°; (III), 23·77°; (IV), 47·57°. F. J. G.

Vapour pressures of certain unsaturated hydrocarbons. A. B. Lamb and E. E. Roper (J. Amer. Chem. Soc., 1940, **62**, 806—814).—Using the static method, the v.p. over the range 10—1000 mm. have been measured for C_2H_4, propylene, $CMe_2{:}CH_2$, Δ^α-butene, *cis*- and *trans*-Δ^β-butene, $\Delta^{\alpha\delta}$-pentadiene, and β-methyl-Δ^β-butene. All the data fit a general equation $\log p = A/T + BT + C$ and most of these substances obey the Ramsay–Young and Dühring rules. Vals. of b.p., slopes of v.p. curves, and heats of vaporisation are deduced. V.p. measurements for liquid and cryst. propadiene (triple point = 136·94±0·02° K. at 0·1448 mm.) are given. W. R. A.

Empirical equation for thermodynamic properties of light hydrocarbons and their mixtures. I. Methane, ethane, propane, and *n*-butane. M. Benedict, G. B. Webb, and L. C. Rubin (J. Chem. Physics, 1940, **8**, 334—345).—An equation for the isothermal variation with ρ of the work content of pure hydrocarbons in the gaseous and liquid states is given and from it may be computed the P–V–T properties of the gas or liquid phase, crit. properties, effect of pressure on H, the fugacity, v.p., and latent heats of vaporisation. Numerical vals. for parameters of the equation are given for CH_4, C_2H_6, C_3H_8, and n-C_4H_{10} and compared with observed vals. W. R. A.

Determination of thermodynamic parameters of real gases, and investigation of water vapour, air, and diatomic gases. M. P. Vukalovitsch and I. I. Novikov (Bull. Acad. Sci. U.R.S.S., Cl. Sci. Tech., 1939, No. 8, 101—129).—Equations for various thermodynamic magnitudes have been deduced from the equation of state previously derived (A., 1940, I, 18). The results agree well with the existing data for the thermodynamic properties of air and H_2O vapour. The methods previously employed have been successfully applied to the investigation of the thermodynamic properties of diat. gases. R. C.

Viscosity of gases for low pressures at room temperature and at low temperatures. A. van Itterbeek and O. van Paemel (Physica, 1940, **7**, 273—283).—Measurements by the oscillating-disc method, at 10^{-3}—10 mm. Hg and room temp. and liquid O_2 and H_2 temp., show that for H_2, D_2, Ne, and

He η varies with pressure in the manner previously found with He at low pressures (A., 1938, I, 304).
L. J. J.

Temperature variation of viscosity of non-polar and dipolar inorganic liquids. S. T. BOWDEN and A. R. MORGAN (Phil. Mag., 1940, [vii], **29**, 367—378).—The variation with temp. of the viscosities of $SiCl_4$, 0—35°, PCl_3, 0—50°, $AsCl_3$, S_2Cl_2, and $POCl_3$, 0—80°, $SOCl_2$, 0—65°, and SO_2Cl_2, 0—50° have been measured for the temp. ranges stated. Results and previous vals. for $BiCl_3$ and $SnCl_4$ conform fairly closely to the Andrade relation, the largest deviations being shown by PCl_3 and $SnCl_4$.
O. D. S.

Activation energy and heat of melting of fatty acids and triglycerides calculated from temperature relations of viscosity. M. P. VOLAROVITSCH and G. B. RAVITSCH (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 252—255).—An attempt has been made to apply the equation $\eta = Ae^{B/RT}$ (where A, B, and R are consts.) to the data obtained previously (A., 1936, 156) for the higher fatty acids and triglycerides (I) of varying degrees of saturation. Fatty acids in the liquid state show no changes in co-ordination no. of mols. within the temp. range 20—110°. For (I), an increase in co-ordination no. of mols. occurs on raising the temp., owing to the smaller influence of directed forces, and both acids and (I) are regarded as mol. liquids with a OH or H bond. In contrast to Ward's results (A., 1937, I, 125), the heats of melting L for fatty acids are found to be $>B$, the activation energy. Comparison of L and B for (I) cannot be made because of the lack of reliable vals. of L.
W. R. A.

Calculation of vapour pressures of binary liquid mixtures. V. DE LANDSBERG (Bull. Soc. chim. Belg., 1940, **49**, 21—58).—The first part of a review of methods of verifying and calculating v.p.–concn. isotherms.
F. L. U.

Viscosity of hydrocarbon solutions : methane–ethane–crystal oil system. B. H. SAGE and W. N. LACEY (Ind. Eng. Chem., 1940, **32**, 587—589).—Data on η for CH_4–C_2H_6–crystal oil mixtures at 100° F. and at $\not>$2500 lb. per sq. in. are given.
F. J. G.

Freezing points of the system ethylene glycol–methanol–water. F. H. CONRAD, E. F. HILL, and E. A. BALLMAN (Ind. Eng. Chem., 1940, **32**, 542—543).—F.p. data for the system are recorded.
F. J. G.

Freezing points in mixtures of strong electrolytes. M. RANDALL and B. LONGTIN (J. Physical Chem., 1940, **44**, 427—435).—Theoretical. For solutions containing mixed electrolytes the f.p. function j (cf. A., 1928, 365) is defined as $1 - (\theta/\lambda\Sigma_i m_i)$ (θ = f.p. lowering, λ = mol. lowering, and $\Sigma_i m_i$ = total ionic molarity). On plotting the function $j\ \Sigma_i m_i/2\mu^{1\cdot5}$ against $\mu^{1\cdot5}$ (μ = total ionic strength) curves are obtained which are in approx. superposition for all electrolytes and which approach the same point at $\mu = 0$. For single electrolytes $\Sigma_i m_i/2\mu^{1\cdot5} = 1/wm^{0\cdot5}$, where w is a valency factor. This form of plotting has the advantage of permitting the curve to be drawn by analogy if one f.p. measurement is made. J. W. S.

Chlorofluoroethanes as solvents for cryoscopic determination of mol. wt. J. BERNSTEIN and W. T. MILLER (J. Amer. Chem. Soc., 1940, **62**, 948—949).—C_2Cl_5F, $(CCl_2F)_2$, and $CCl_3{\cdot}CClF_2$ are suitable for cryoscopic determination of mol. wts., the cryoscopic consts. being 42·0, 37·7, and 38·6, respectively.
R. S. C.

Cryoscopy in hydrazine hydrochloride. A. CHRÉTIEN and A. NESSIUS (Bull. Soc. chim., 1940, [v], **7**, 258—275).—The cryoscopic const. of anhyd. N_2H_4,HCl (I), as determined with $CO(NH_2)_2$, is 50·2. NH_4Cl, $(N_2H_4)_2,H_2SO_4$, $N_2H_4,2HCl$, and N_2H_4,HNO_3 as solutes also yield a similar val. This may be due to non-dissociation of these salts or to the circumstance that the $N_2H_5^{\cdot}$ or Cl' ions formed by dissociation do not affect the m.p. of (I). N_2H_4,H_2SO_4 (II), $HgCl_2$, and $PbCl_2$ yield a val. of ~100 for the cryoscopic const. of (I). This behaviour, in spite of the fact that dissociation would be expected to yield $N_2H_5^{\cdot}$ or Cl' ions, is attributed to the formation of complex ions with (I), or in the case of (II) to the formation of $H^{\cdot}$ and SO_4'' ions.
J. W. S.

Effect of irradiated electrical energy on crystallisation. K. HOFER (Atti X Congr. Internaz. Chim., 1938, IV, 449—460).—When glass vessels in which substances (*e.g.*, $CaCO_3$, NaCl) are crystallising from aq. solution are fitted with Sn plates and inserted as condensers in the circuit of a radio receiving or transmitting set, the crystals formed are smaller than, and of different shape from, those separating under normal conditions.
F. O. H.

Absorption and dispersion of sound in a solution of a weak electrolyte. I. G. SCHAPOSCHNIKOV and M. A. LEONTOVITSCH (J. Phys. Chem. Russ., 1939, **13**, 781—785).—The theory of absorption and dispersion is developed on similar lines to Einstein's theory for gases.
R. C.

Anisotropy of light absorption of dissolved molecules in an electrical field. W. KUHN, H. DÜHRKOP, and H. MARTIN (Z. physikal. Chem., 1939, **45**, **B**, 121—155).—If a solution of a coloured dipolar substance is placed in an electrical field partial orientation of the mols. results. The absorption of light by these mols. is determined by the magnitude of the orientation with respect to the incident beam. The magnitude of the electrodichroism is theoretically dependent on the dipole moment of the mols., the direction of vibration for a given λ, and the strength of the applied electrical field. The electrodichroism for solutions of p-$NO{\cdot}C_6H_4{\cdot}NMe_2$ (I) in C_6H_{14} has been measured for 4359, 4047—4078, and 3655 A. There is complete dichroism for 4359 A., the mols. absorbing only light of which the electrical vector vibrates perpendicular to the dipole axis of the mols. For 4047—4078 A. and 3655 A. the dichroism is weaker; the absorption of light of which the electrical vector vibrates parallel to the dipole axis of the mols. is approx. double that of which the electrical vector vibrates parallel to this axis. Since all these belong to the same absorption band of the mols. the absorption band must be a superposition of at least two bands which possess different modes of vibration. The measurements establish the presence of anisotropy of the modes of vibration of absorption bands of org.

mols. From the anisotropy of optical absorption of dissolved mols. on the one hand and of crystals on the other, the possibility of determining the orientation of mols. in crystals is discussed. Data on the anisotropy of light absorption of crystals of (I) are given.
W. R. A.

Viscosity and solvation. II. S. Bezzi (Gazzetta, 1940, **70**, 110—118).—Measurements of η of dil. solutions of polydimethyl glycols in various solvents have been made. Some of the solutions behave normally, $\eta_{sp.}$ being $\propto$ mol. wt. Abnormal variations of η with concn. are attributed to solvation.
O. J. W.

Diffusion in solids. R. M. Barrer (Proc. Physical Soc., 1940, **52**, 58—70).—A summary and discussion of data on diffusion consts. in ionic and metallic systems in terms of the Fick–Matano diffusion equation $D = D_0e^{-E/RT}$, where E = energy of activation for diffusion. Data for 18 ions in salts and 56 metal systems are tabulated. Theories of diffusion are outlined, and expressions for D and its relation to other physical quantities are considered. Similarities between diffusion and chemical reaction are brought out by considering the entropy of activation and periodicity curves for D_0. N. M. B.

Isomorphous relationships of organic compounds of analogous constitution.—See A., 1940, II, 196.

Generalisation of the Heisenberg–Bloch theory [applied to] binary ferromagnetic alloys. S. V. Vonsovski (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 570—572).—Mathematical. W. R. A.

Formation of nuclei [in alloys] during precipitation. R. Becker (Proc. Physical Soc., 1940, **52**, 71—76).—Mathematical. An application of the treatment of condensation in vapours shows that when an alloy in which pptn. is to take place is cooled, the process begins with observable velocity only when the temp. has fallen by a definite amount below that at which the single-phase alloy is in equilibrium. This fact is explained by a theory of nuclear formation. Calculation of the rate of formation of nuclei is examined. N. M. B.

Influence of elastic strain on the shape of particles segregating in an alloy. F. R. N. Nabarro (Proc. Physical Soc., 1940, **52**, 90—93).—Mathematical. An estimate of the dependence of strain energy associated with a particle of ppt. on the shape of the particle shows that the energy can be reduced only if the ppt. forms in flat plates, and then only in the case of particles which have broken away from the lattice of the matrix. N. M. B.

Estimate of degree of precipitation-hardening [in alloys]. N. F. Mott and F. R. N. Nabarro (Proc. Physical Soc., 1940, **52**, 86—89).—Mathematical. Assuming diffusion to result in an interchange of atoms, the internal strains produced by pptn. are calc. on the basis of a simple model. By the dislocation theory these strains are responsible for the hardness of the material and so the degree of hardening can be predicted. N. M. B.

Modulus of elasticity of alloys.—See B., 1940, 366.

Variation of principal elastic moduli of Cu_3Au with temperature. S. Siegel (Physical Rev., 1940, [ii], **57**, 537—545).—Single crystals of Cu–Au alloy, containing 24·92 at.-% Au, prepared in a vac. furnace were brought to the ordered state at room temp. by annealing. The elastic moduli, measured by the composite piezoelectric oscillator method, are tabulated as a function of temp. for the range 20—450°. At the crit. temp. 387·5° there is a discontinuity in each modulus–temp. curve. Results indicate that the elastic consts. are closely related to the degree of local order. N. M. B.

Optical constants of the copper–aluminium α-alloys. L. McPherson (Proc. Physical Soc., 1940, **52**, 210—216).—Experimental vals. of n, extinction coeff., absorption coeff., and reflecting power in the range 5000—9500 A. are given. Curves show the variation of the consts. with λ, and interpretation is briefly discussed. N. M. B.

Age-hardening of copper–aluminium alloys. G. D. Preston (Proc. Physical Soc., 1940, **52**, 77—79).—The ageing of Al alloys containing 4% of Cu is discussed. At room temp. the Cu atoms segregate on the (100) planes of the crystals, but no new phase is formed. At 200° a pseudomorphic form of $CuAl_2$ is pptd. N. M. B.

Alloys of germanium with bismuth, antimony, iron, and nickel [and of silicon with nickel]. K. Ruttewit and G. Masing (Z. Metallk., 1940, 32, 52—61).—All the systems were examined by thermal and micrographic methods using alloys melted in a N_2 atm. Bi and Ge are insol. in one another in the solid state; they form no eutectic and no compound. Sb and Ge are also insol. in one another in the solid state but form a eutectic at 588°, Ge 19 at.-%. Fe dissolves 13 at.-% of Ge at 700° and 19 at.-% at 1100°; two compounds are formed at max. on the liquidus curve corresponding with Fe_2Ge, 1180°, and $FeGe_2$, 866°; $FeGe_2$ forms, however, only on slow cooling, a eutectic crystallising at 835° if molten $FeGe_2$ is cooled rapidly. Fe_2Ge forms a eutectic with Fe at 1125°, Ge 29 at.-%. In the Ni–Ge system there is only one compound, Ni_2Ge (ϵ), m.p. 1200°, which forms a eutectic with Ge at 775°, Ge 60·3 at.-%; Ni dissolves 12 at.-% of Ge at all temp. <1160° but Ge does not appear to dissolve Ni below 900°. The system is very complex between 23 and 33 at.-% of Ge, four intermediate phases being formed, two of which, γ and γ', have remarkably small composition and temp. ranges; at 1161° β (Ge 22·8 at.-%) is formed from liquid + α, at 1155° γ (Ge 26·4 at.-%) from liquid + β, at 1135° δ (Ge 29·6 at.-%) from liquid + ϵ, and at 1015° γ' (Ge 26·3 at.-%) from β + δ. At 850° ϵ reacts with liquid to form η with Ge 50 at.-%, and below 970° the γ and δ phases decompose into β + δ. There appears to be a second eutectic at 1130°, Ge 28·9 at.-%, but owing to the close proximity of this point to the δ peritectic a true eutectic structure is difficult to obtain. A re-examination of the Ni–Si system up to 35 at.-% of Si has confirmed in general the diagram of Iwasé and Okamoto (cf. B., 1940, 452) except that the various horizontals are placed at slightly higher temp. owing to the greater purity of the Si used; the heat effects previously observed at 1040° (Si 10—28

at.-%) and at 1214° (Si 28—34 at.-%) do not occur in pure alloys. A. R. P.

Order–disorder transformation in the alloy Ni_3Mn. N. THOMPSON (Proc. Physical Soc., 1940, **52**, 217—228).—Curves for the temp. variation of magnetisation, electrical resistance, and sp. heat during and after various heat-treatments are given. Results indicate an order–disorder transformation at 510°, the ordered structure being ferromagnetic with a Curie point at 460°. The sharp decrease of resistance on slow cooling takes place at the Curie point. The effect of the degree of order and size of the ordered regions on resistance and magnetisation is discussed. N. M. B.

Recrystallisation of iron–nickel alloy.—See B., 1940, 362.

***X*-Ray evidence of intermediate stages during precipitation from solid solution.** A. J. BRADLEY (Proc. Physical Soc., 1940, **52**, 80—85).—On heating for shorter times than are necessary for attainment of equilibrium, intermediate metastable structures resulting from the partial decomp. of solid solutions were found in the Cu–Ni–Al, Fe–Ni–Al, and Fe–Cu–Ni systems. In each case a single-phase structure, stable at high temp., breaks up into two phases on cooling. The first stage in the decomp. is the formation of islands in which atoms segregate prior to pptn.: $CuNi_2Al$ from a Cu-rich solid solution, and FeNiAl from an Fe-rich solid solution. During the decomp. of $FeCu_4Ni_3$ into two phases, a laminated structure is produced in which Cu-rich and Fe–Ni-rich laminæ alternate. Each has a tetragonal structure with the same *a* axes as in the solid solution; in the Cu-rich laminæ $c>a$; in the other $c<a$. N. M. B.

***X*-Ray study of structure of ternary solid solutions of aluminium with magnesium and silicon and their ageing.** V. G. KUZNETZOV and E. S. MAKAROV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 245—249).—An *X*-ray study has been made of homogeneous alloys tempered at 550°, 500°, 400°, and 200° the compositions of which are represented by points along six radial sections, up to a Mg + Si content of 2·2%, in the Al corner of the phase diagram of the system Al–Mg–Si. The solubility data agree with those given by Urazov and Schuschpanova (cf. B., 1937, 1357) for all temp. except 200°. Experimental curves representing the changes in the parameters of the solid solution differ from the calc. linear curves for one radial section passing along the line of simultaneous saturation with Si and Mg_2Si. This indicates that Mg_2Si is molecularly dispersed in the Al solid solution, but in too small a concn. for its lattice to be detected by *X*-ray methods. The ageing of the tempered alloys at room temp. does not cause parameter changes, but with artificial ageing the lattice consts. approach the Al parameter. After both natural and artificial ageing a heterogeneity in composition is indicated. W. R. A.

Solubility of carbon dioxide in water at various temperatures from 12° to 40° and at pressures to 500 atmospheres. Critical phenomena. R. WIEBE and V. L. GADDY (J. Amer. Chem. Soc., 1940, **62**, 815—817; cf. A., 1939, I, 194).—Determinations of the solubility of CO_2 in H_2O at 12°, 18°, 25°, 31·04°, and 40° at pressures up to 500 atm. indicate complete miscibility, particularly for the lower temp. An approx. crit. curve has been obtained with a pressure max. at 75°. Solid $CO_2,6H_2O$ separates at pressures >50 atm. at 10° and over the pressure range 300—500 atm. at 12°. W. R. A.

Binary and ternary systems separating into two liquid layers. Inversion of densities. P. MONDAIN-MONVAL and J. QUIQUEREZ (Bull. Soc. chim., 1940, [v], **7**, 240—253).—The *d* of the two layers in the systems H_2O–NH_2Ph and H_2O–*o*-$C_6H_4Me{\cdot}NH_2$ have been measured, and the temp. at which the *d* of the layers become equal have been determined. The compositions and *d* of the conjugated solutions in the systems H_2O–EtOH–PhMe and H_2O–EtOH–*m*-xylene have been measured at 25°. In each case inversion of *d* occurs near the crit. solution point. The conditions under which inversion of densities occurs in such systems are discussed. J. W. S.

Partial miscibility in liquid alloys. System lead–zinc–tin. P. MONDAIN-MONVAL and G. GABRIEL (Bull. Soc. chim., 1940, [v], **7**, 113—121).—Pb–Sn–Zn alloys of [Sn] <29% separate into two phases at 520°. The crit. miscibility point occurs with Pb 30·5, Sn 29, and Zn 40·5%. The [Sn] in the Pb layer is < in the Zn layer, and evidence is obtained of the existence of Pb_3Sn, partly dissociated, in the Pb phase. J. W. S.

Solubility and molecular rotation of tetra-, penta-, and hexa-substituted benzenes. C. P. SMYTH and G. L. LEWIS (J. Amer. Chem. Soc., 1940, **62**, 949—952).—The solubilities in C_6H_6 at various temp., temp. below which rotation ceases, heats and entropies of fusion, and dipole moments are given and discussed for C_6Cl_6, C_6Me_6, 1 : 3 : 5 : 2 : 4 : 6- and 1 : 2 : 5 : 3 : 4 : 6-$C_6Me_3Cl_3$, 1 : 2 : 3 : 4 : 5 : 6-$C_6Me_4Cl_2$, C_6Me_5Cl, C_6HCl_5, C_6MeCl_5, 1 : 2 : 3 : 4 : 5 : 6-$C_6Me_2Cl_4$, 1 : 2 : 3 : 4 : 5-$C_6HMe_2Cl_3$, 1 : 2 : 4 : 5-$C_6H_2Me_2Cl_2$, and C_6MeCl_5. W. R. A.

Solubility in the systems $NaBr$–$NaBrO_3$–H_2O–$NaHCO_3$ and –Na_2CO_3. G. S. KLEBANOV and E. P. BASOVA (J. Appl. Chem. Russ., 1939, **12**, 1601—1609).—Phase diagrams are given for the systems $NaBr$–$NaBrO_3$–$NaHCO_3$–H_2O at 25° and 35°, and $NaBr$–$NaBrO_3$–Na_2CO_3–H_2O at 80°. NaBr greatly depresses the solubility of all the other salts, whilst $NaBrO_3$ depresses only that of $NaHCO_3$. When solutions containing NaBr and $NaBrO_3$ are evaporated until crystallisation commences, and the temp. is lowered to ≯10°, $NaBrO_3$ separates in 80% yield. Recovery of further $NaBrO_3$ from the mother-liquors is not possible; pure NaBr is obtained by reducing $NaBrO_3$ to NaBr. $NaHCO_3$ separates out together with NaBr or $NaBrO_3$; this may be prevented by converting it into more sol. Na_2CO_3, by heating the solutions, and then returning the liquor for bromination, or by adding bromides the cation of which combines with CO_3'' to form insol. carbonates. R. T.

Distribution of bromine between crystals and solution of potassium chloride and bromide. S. K. TSCHIRKOV (J. Appl. Chem. Russ., 1939, **12**,

1747—1752).—Polemical against Schlesinger *et al.* (A., 1939, I, 253). R. T.

Determination of constants of water absorption by dry organic substances. C. A. SHULL and S. P. SHULL (Plant Physiol., 1939, **14**, 351—357).—Mathematical. A. G. P.

Gibbs' relation and adsorption formulæ. A. BOUTARIC (J. Phys. Radium, 1940, [viii], **1**, 99—102).—Theoretical. The basis and utility of the Gibbs relation are discussed and an equation is deduced of the form $p = RTu/m$, where p is the diminution in γ due to surface-adsorbed mols. and u is the concn. per unit area of surface. When the adsorption is represented by the Langmuir–Perrin equation $m = 1$. The relation between u and the concn. of the solution is also given. W. R. A.

Elasticity of organo-gels in relation to hysteresis in sorption. K. S. RAO (Current Sci., 1940, **9**, 19—21).—Ca arabate (I), activated at 60° in a vac. for 30 min., was degassed for 5 hr. in a vac. and a series of sorptions and desorptions was conducted at 30° using the quartz fibre spring balance. 14 days were required to complete each cycle. Hysteresis exhibited in the first cycle falls away in subsequent cycles and completely disappears in the fourth. This behaviour, similar to that of rice grain (B., 1939, 985), can be similarly explained on the cavity concept of hysteresis. The hysteresis loop in the first cycle extends to a R.H. of 0·78, corresponding with a max. cavity radius of 40·5 A. The loop extends to zero pressure, indicating that the necks of the cavities have mol. dimensions. The behaviour of dhal grain (*Cajanus indicus*) is similar. A series of sorptions and desorptions of $CHCl_3$ vapour on the activated grain shows the existence of a permanent hysteresis loop reproducible at the ninth cycle, whereas the loop of H_2O disappears in the third cycle. W. R. A.

Permanence of the hysteresis loop in sorption. K. S. RAO (Current Sci., 1940, **9**, 68—70).—In a series of sorptions and desorptions of H_2O vapour on suitably treated Al_2O_3 gel (cf. A., 1937, I, 129) at 30° two months elapsed between the beginning of the first sorption and the ending of the tenth desorption, and the hysteresis loop obtained was permanent and reproducible. This is explained on the basis of the cavity concept (see above). Al_2O_3 retains 2·6% of H_2O irreversibly at the end of the first desorption, and this remains almost unaltered, owing to the H_2O being trapped in the gel interstices, or held on the surface as OH attached to Al_2O_3 (cf. silicic acid, A., 1936, 272). The peak of the loops extends to the saturation point, showing that some of the cavities in the Al_2O_3 gel are microscopic. W. R. A.

Rate of sorption in relation to hysteresis. K. S. RAO (Current Sci., 1940, **9**, 70—72).—The idea of a cavity (cf. preceding abstract) having narrow necks has been supported by measuring the rates of sorption of H_2O vapour on SiO_2 (I), TiO_2 (II), Al_2O_3 (III), and Fe_2O_3 (IV) gels. These gels were activated, and degassed in a vac. for 5 hr., and a series of sorptions and desorptions conducted at 30°, hysteresis being exhibited by all. After a definite no. of cycles, 2 for (I), 29 for (II), 9 for (III), and 9 for (IV), the rates of sorption of H_2O on the gels were measured, by measuring the amount of H_2O held reversibly by the gels. Except for (I), the sorption isotherms show a clear inflexion marking a transition from a unimol. adsorption to capillary condensation, and the rate of sorption is shown to be mainly the rate of filling of the capillaries. The time intervals for complete sorption vary widely, but the amounts of sorbed H_2O at equilibrium, per g. of gel, are almost identical. The rate differences are ascribed to the difference in size and no. of the cavities, and the rate of sorption is the rate of creeping of condensed liquid in the neck into the interior of the cavity, dependent on the difference in v.p. outside and inside the cavity. This explains the quick filling up of gels having small cavities, such as (I). W. R. A.

Characteristics of adsorptive and catalytic properties of iron catalysts.—See B., 1940, 356.

Adsorption of hydrochloric and sulphuric acids by commercial active charcoals. A. A. KOT (J. Appl. Chem. Russ., 1939, **12**, 1653—1663).—HCl and H_2SO_4 are removed from aq. solutions by active C, which is regenerated by treatment with aq. NaOH, Na_2CO_3, or $NaHCO_3$. R. T.

Adsorption of proteins by montmorillonitic clays.—See B., 1940, 385.

Ion adsorption by pectin. G. H. JOSEPH (J. Physical Chem., 1940, **44**, 409—411).—The conclusions of Spencer (A., 1930, 418) are incorrect owing to mathematical inaccuracies, and the original view of Tarr (Univ. Delaware Expt. Sta. Bull. 134, 1923) that pectin possesses a buffer action in acid solutions owing to the adsorption of $H^{\bullet}$ ions is substantiated. J. W. S.

Surface tension of ethyl alcohol–water mixtures. W. S. BONNELL, L. BYMAN, and D. B. KEYES (Ind. Eng. Chem., 1940, **32**, 532—534).—Vals. of γ for EtOH–H_2O mixtures (EtOH 2·33—92·72%) between room temp. and the b.p. are given. γ decreases linearly with rising temp., and at const. temp. decreases at first rapidly and then more slowly with increasing [EtOH]. F. J. G.

Type III surface tension curves with minimum in dilute solution in pure hydrocarbons. M. E. L. MCBAIN and L. H. PERRY (J. Amer. Chem. Soc., 1940, **62**, 989—991).—Type III γ curves are given by non-electrolytic detergents, and show a lowering of γ in solutions, which remains const. on further concn. (A., 1940, I, 209). Using hydrocarbons as solvents, type III curves with min. occur in non-ionising media. Dodecanesulphonic acid (I) in Nujol (II), mineral oil (III), and hydrogenated tetra*iso*butylene (IV) shows this min., but in *iso*-C_8H_{18} (type I curve), xylene, C_6H_6, and C_7H_{16}, γ is scarcely lowered. Nonylglucoside does not lower the γ of (II) or (IV) although it is polar, and a non-electrolytic detergent in (II) showed no appreciable lowering. $Pr^{\alpha}CO_2H$ in 20% solution gives a lowering of only 2 dynes, which is given by lauric acid in 3% solution. Ca and Zn stearates have no effect. The production of a type III curve in these hydrocarbons requires such high polarity that the solute forms a colloidal electrolyte or

strong electrolyte in H_2O. The only explanation suggested for the min. in type III curves is that advanced by McBain (A., 1937, I, 130). W. R. A.

Surface equilibrium of complex solutions. P. L. du Nouy (Compt. rend., 1940, **210**, 334—335).—The du Nouy effect has been observed in non-colloidal media (glycerol, sugars, electrolytes; cf. also A., 1940, III, 283). Addition of a trace of Na oleate to 10% aq. glucose reduces the surface tension (γ) from 72 to 47 dynes per cm.; the γ–t curve then rises logarithmically for 28 min., and becomes linear. At 3 hr. the curve bends over, and the initial γ val. is reached or slightly exceeded at 5 hr. With 10% aq. glycerol γ rises logarithmically for 2 hr. after addition of Na oleate. The mechanism of the effect is probably identical with that of neutralisation by colloids. A. J. E. W.

Interfacial tension between a benzene solution of palmitic acid and an aqueous solution of ammonia. Tensiometric study of neutralisation of ammonia by hydrochloric acid. L. Gay and L. Raymond (J. Chim. phys., 1940, **37**, 19—29; cf. A., 1937, I, 130, 612).—The curves obtained by plotting interfacial tension (γ) against log [NH_3] (for const. palmitic acid concn. $\not>$1%) consist of 4 straight lines, alternately horizontal and downward-sloping, the latter indicating const. excess concn. of NH_3 in the interface. Possible interpretations are discussed. Tensiometric titration of aq. HCl with aq. NH_3 is inexact when the solutions are dil., since no sharp change in γ occurs at the point of chemical equivalence. F. L. U.

Interfacial tension between a benzene solution of palmitic acid and an aqueous solution of mono-, di-, or tri-sodium orthophosphate. L. Gay, P. Méjean, and A. Brunel (J. Chim. phys., 1940, **37**, 30—39).—The γ-concn. curves consist of a nearly horizontal portion followed by a steeply descending one, the latter becoming linear when plotted logarithmically. The curves for Na_2HPO_4 have a third less steeply inclined part in addition to the two mentioned, whilst those for NaH_2PO_4 have two additional portions. Tensiometric titration of H_3PO_4 with NaOH, as in the case of NH_3 and HCl (cf. preceding abstract), is impracticable when the solutions are dil. F. L. U.

Surface tension between polarised mercury and an aqueous solution of sulphuric acid. F. Bon (Compt. rend., 1940, **210**, 567—569).—The interfacial tension (γ) between aq. H_2SO_4 (concn. c) and Hg at different potentials (E, measured with reference to a large mass of Hg in the same solution) has been determined by the drop-wt. method. The γ–log c curves are initially horizontal, but as log c increases a linear fall in γ, which is pronounced if E is $\gg$ or $\ll$ 0·8 v., is followed by a further less rapid fall, also linear with log c. The two breaks on each curve lie on parallel straight lines which are slightly inclined to the γ axis. A. J. E. W.

Preparative studies with unimolecular films. I. Continuous preparation of unimolecular layers. F. Kögl and E. Havinga (Rec. trav. chim., 1940, **59**, 249—258).—An apparatus for the investigation of reactions in unimol. films is described. It incorporates a horizontally rotating cylinder half immersed in the liquid on which the films are spread, and by suitable rotation of the cylinder the films can be continuously removed and replaced by new films. C. R. H.

Effect of surface-active substances on rate of evaporation of water from solutions. II. N. I. Glazov (J. Phys. Chem. Russ., 1939, **13**, 840—845; cf. A., 1938, I, 571).—Adsorbed films of n-C_8H_{17}·OH, n-C_7H_{15}·OH, and n-C_6H_{13}·OH on the surface of H_2O retard evaporation. The relative retardation increases with decrease in the rate of evaporation from the uncontaminated surface. With increase in the amount of alcohol the rate of evaporation, v, falls, passes through a min. when the surface film is still unsaturated, and, in absence of special precautions, rises again. If, however, the system is freed from suspended droplets by cooling and filtering, v remains const. after reaching the min. val. (cf. A., 1939, I, 467). It is inferred that the retardation of the evaporation of H_2O by adsorbed films is connected with their stabilising action and mechanical properties. R. C.

Residual active layer [of aluminium oxide]. A. Miyata (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 30—57).—The dielectric properties of an anodic film of Al_2O_3 produced in $H_2C_2O_4$ solutions have been investigated. The wetted film acts as if it had a large capacity; the effect is greater in the ordinary film than in one which has been heated in steam, the difference being due to alteration in porosity. The dielectric const. of the dry film is ~8. That of an anodic Al_2O_3 film produced by a.c. is decreased by heating. The effect of a large no. of compounds on the destruction of the film has been investigated. A. J. M.

Structure and physico-chemical properties of surface layers of substances of high mol. wt. III. Molecular structure and surface properties of hair and wool keratin. V. A. Ptschelin (J. Appl. Chem. Russ., 1939, **12**, 1495—1500).—The surface layer of defatted hair (human, horse) is shown by measurement of the angles of contact with H_2O and C_6H_6 to be hydrophobic; mechanical removal of this layer exposes a hydrophilic surface. The polar groups of the keratin mol. are therefore oriented towards the interior of the hair. R. T.

Mechanism of boundary lubrication suggested by the static friction of esters. A. Fogg (Proc. Physical Soc., 1940, **52**, 239—245).—The relation between the coeff. of friction and the mol. wt. of a series of Me and Et esters lubricating steel surfaces was investigated. The coeff. showed a max. val. at a mol. wt. of ~120. Results are explained on the assumption that the mols. in the boundary layer are attached to the surface by means of the double-bond O atom in the ester, that each mol. has two divergent arms projecting from the surface, and that the orientation of these parts of the mol. relative to the surface varies with mol. wt. and depends on the relative wts. of the arms. N. M. B.

Mechanical effects of intercrystalline boundaries. B. Chalmers (Proc. Physical Soc., 1940, **52**,

127—131).—The effect of a single-crystal boundary on the crit. shear strength of a metal is discussed. N. M. B.

Water-in-oil emulsifying agents.—See B., 1940, 402.

Properties of superconducting colloids and emulsions. D. SHOENBERG (Proc. Roy. Soc., 1940, A, **175**, 49—70; cf. A., 1939, I, 257).—The variation of magnetic susceptibility with particle size was investigated, the material used being colloids and emulsions of Hg. The results are in agreement with those obtained by other workers using thin films of Hg, but suggest that the London law of penetration is not quantitatively valid. The crit. field at which magnetisation disappears is greater for colloids and emulsions than for Hg in bulk. Observed differences between the shape of the magnetisation curves and hysteresis features are discussed. G. D. P.

London–van der Waals forces between two disc-like particles. G. P. DUBE and H. K. DAS GUPTA (Indian J. Physics, 1939, **13**, 411—417).—A detailed account of work already noted (A., 1939, I, 520). W. R. A.

Brownian movement and the Einstein formula. J. DUCLAUX (J. Phys. Radium, 1940, [viii], **1**, 81—84).—Theoretical. The application of the Einstein formula to the Brownian movement of a particle in a viscous liquid is reviewed and its inadequacy indicated. W. R. A.

Optical and magnetic properties of a magnetite suspension. C. W. HEAPS (Physical Rev., 1940, [ii], **57**, 528—531).—A suspension of magnetite powder in oil acts in a limited way as a light shutter. Transmission is greater when a magnetic field is parallel than when it is transverse to the light direction. Magnetic examination shows that the particles form elongated groups, each particle being probably a single magnetic domain magnetised to saturation and hence attracting neighbouring particles. An equation (not well verified by experiment) for the amount of transmitted light in terms of magnetic field strength is deduced. The experimental magnetisation curve of a dense suspension fits the Langevin curve fairly well. The group of particles forming the magnetic element has an intensity of magnetisation $\ll$ the saturation val., although the individual particles are probably single saturated domains. N. M. B.

Sediment volumes and rate of sedimentation of multidisperse kaolin, quartz, and soil powders in electrolyte solutions. I. G. G. KANDILAROV (Kolloid-Z., 1940, **90**, 320—340).—The vol. (V) of sediment from a kaolin suspension increases slightly with increasing concn. of NaCl to a max., and then decreases steeply to a min. at ~0·2N. The curve for Na_2SO_4 is similar, but displaced towards lower concns. With $CaCl_2$ V shows little change with concn., whilst with $AlCl_3$ it rises to a high max. at ~5 mmol. per l. and thereafter falls rapidly. Quartz powder suspensions give V vals. which are much less affected by salts than are those for kaolin, and mixtures of quartz and kaolin behave in an additive manner. Two washed soil samples behaved similarly to quartz. The rate of sedimentation of quartz powder in aq. AcOH runs parallel with the mutual adhesion of the particles. F. L. U.

Silicic acid as a protective colloid for manganese dioxide sols. F. HAZEL (J. Physical Chem., 1940, **44**, 422—427).—Addition of SiO_2 sol increases the stability of MnO_2 sols towards flocculation by KCl, $BaCl_2$, and $Th(NO_3)_4$. The mobilities of MnO_2 sols, SiO_2 sols, and of MnO_2 sols protected by SiO_2 have been measured in the presence of various concns. of KCl, $BaCl_2$, or $Th(NO_3)_4$ and at various p_H vals. The fact that the migration velocity of the particles is frequently uniform suggests that the SiO_2 and MnO_2 are mutually adsorbed. SiO_2 sols are flocculated by very low [$Th^{····}$], but are recharged in 10^{-5}—10^{-6}M-$Th(NO_3)_4$. J. W. S.

Variation in composition of intermicellar liquid during ultrafiltration of a colloidal solution. A. BOUTARIC (Ann. Soc. Sci. Bruxelles, 1940, **60**, 31—36).—Ultrafiltration of a colloid of the type Na^+R^- in presence of, *e.g.*, NaCl does not result in a significant difference between the compositions of ultrafiltrate and intermicellar liquid if the Donnan membrane equilibrium is established on both sides of the filter. L. J. J.

Sodium palmitate curd as studied in the centrifuge. J. W. McBAIN and T. F. FORD (J. Amer. Chem. Soc., 1940, **62**, 866—869).—Soap curd, a felt of hydrated cryst. fibres enclosing slightly alkaline H_2O, has been examined in the centrifuge. Its structure is firm enough for Na palmitate curd of concn. >0·2M. not to sediment or crush in a centrifugal field of 250,000*g*. From the rate of collapse of the structure, the pore diameter was calc. as 400 A., which is due to the bundling of parallel fibres, in themselves <100 A. in diameter. Glycerol softens the curd, and NaCl gives it a form which is too rigid to collapse but yields H_2O readily on cutting; the cut curd then collapses. The effect is one of structure or of reduced hydration rather than of a retardation of "capillary" flow. W. R. A.

Colloid chemistry of system soaps–cresol–water. V. Viscosity of stearate solutions in presence of electrolytes and cresol. E. ANGELESCU and S. SZÁSZ (Kolloid-Z., 1940, **90**, 302—315; cf. A., 1940, I, 71).—Data are recorded for η of 0·2N-K and -Na stearate solutions in presence of varying concns. of KCl and of NaCl respectively and of cresols. The η changes due to cresol become more marked in presence of the salt, but the form of the curves remains unchanged. The effectiveness of the cresols increases in the order *o*-< *m*-< *p*-. The data are interpreted in terms of the theory previously put forward. F. L. U.

Viscosity of dilute solutions of long-chain molecules. III. Staudinger viscosity law. M. L. HUGGINS (J. Appl. Physics, 1939, **10**, 700—704).—Sources of error in the derivation (cf. A., 1939, I, 318) of Staudinger's viscosity law for dil. solutions of long-chain mols. are discussed. O. D. S.

Polybutylenes.—See B., 1940, 342.

Stability relations in organosols of macromolecular compounds. H. Erbring (Kolloid-Z., 1940, **90**, 257—268).—Work previously reported (A., 1939, I, 75) has been extended to organosols of polyvinyl chloride (I), poly*iso*butylene (II), Me polymethacrylate (III), and benzylcellulose (IV) in various solvents. The pptg. power of aliphatic *n*-alcohols decreases with increasing mol. wt. (C_1—C_9) for (I) and (II), whilst the reverse order holds for (III). (IV) exhibits max. stability towards $C_6H_{13}\cdot OH$. There is a linear relation between $1/c$ and $1/\epsilon$ (c = pptg. concn. of alcohol). F. L. U.

Gelatinisation of cellulose nitrates. (Mlle.) T. Petitpas (J. Chim., phys., 1940, **37**, 6—18).—Previous work (*e.g.*, Mathieu, A., 1934, 956; B., 1939, 443) on the absorption of ketones by cellulose nitrates is summarised, and attention is drawn to the stabilisation of the internal structure which occurs when the mol. fraction of the gelatinising liquid is 0·5 (counting glucose unit as 1 mol.), independently of the N content. With $MeNO_3$ as the gelatinising liquid the di- and trinitrates show differences in behaviour when the mol. fraction is >0·5. F. L. U.

Cellulose esters of dibasic organic acids.—See B., 1940, 350.

Viscosities of arabogalactan solutions.—See A., 1940, II, 207.

Physical chemistry of secalin. Electrophoresis and diffusion constant studies of the prolamine of rye. A. C. Andrews (J. Amer. Chem. Soc., 1940, **62**, 942—948).—The diffusion const. of secalin in 70% aq. EtOH, at 25°, calc. to H_2O basis, is $4·78 \times 10^{-7}$ sq. cm. per sec., giving a mol. wt. of ~40,000. The isoelectric point is at p_H 6·67. The dielectric dispersion curve has been determined over a frequency range of 24·2 kc. to 24·2 Mc.; solutions containing 0·695 and 0·526 g. of secalin per 100 c.c. had [α] −66·2° and −69·3°, respectively. The extraction and purification of secalin are described. W. R. A.

Coacervation. A. Dobry (Bull. Soc. Chim. biol., 1940, **22**, 75—86).—A review of work published previously (cf. A., 1938, I, 246; 1939, I, 198, 418). A. L.

Mutual coagulation of colloidal solutions. Interaction of copper ferrocyanide with ferric hydroxide. P. M. Barve, V. C. Vora, and B. N. Desai (J. Indian Chem. Soc., 1939, **16**, 645—651).—The zone of mutual coagulation of $Fe(OH)_3$, of $Th(OH)_4$, and of $Ce(OH)_4$ with $Cu_2Fe(CN)_6$ depends on the charge on the particles as in the case of Prussian-blue (A., 1940, I, 162). Reaction of the peptising electrolytes and impurities has no important influence. F. R. G.

ζ-potential at the solid–water interface in relation to the inner micellar or crystalline structure of the former. II. Change of ζ-potential of hydrous cellulose on change of the degree of micellar parallelism. K. Kanamaru and T. Takada (Z. physikal. Chem., 1940, **186**, 1—9; cf. A., 1940, I, 113).—The initial and equilibrium vals. of ζ for viscose fibres in H_2O are respectively greater and smaller, the lower are the degree of parallelism of the crystallites, in accordance with the theory of Kanamaru (A., 1937, I, 80). F. J. G.

Surface conductivity. I. Surface conductivity of cellulose and its derivatives in relation to their lyophily. K. Kanamaru and T. Takada (Z. physikal. Chem., 1940, **186**, 10—18).—The surface conductivity (χ) of cellulose nitrate (I) in H_2O, MeOH, and EtOH at 20° increases with decreasing N content, *i.e.*, increasing lyophilic character of the solid phase. χ for cellulose and cellulose hydrate increases with time to a limiting val., with both stationary and streaming fluid. χ for glass in H_2O and for (I) in EtOH decreases as the degree of drying of the solid before use increases. Results are discussed in terms of solvation and are compared with ζ-potentials. R. S. B.

Electrokinetic potential of cellulose and its derivatives. K. Kanamaru and T. Takada (Kolloid-Z., 1940, **90**, 315—319).—Vals. of the ζ-potential of various kinds of cellulose and of cellulose acetates and nitrates, determined by an improved method, are recorded. These vals. supersede those published previously (cf. A., 1931, 1232). F. L. U.

Comparison of the cataphoretic and electro-osmotic methods of measuring electrokinetic potential. D. N. Ghosh and P. C. Roy (J. Indian Chem. Soc., 1939, **16**, 634—638).—The velocities of cataphoresis and electro-osmotic flow, measured for spherical particles (kaolin and SiO_2, uncoated and coated with protein, and As_2S_3) having the same electrokinetic potential, give identical vals. for the coeff. in the expression for the respective velocities. The coeff. for the cataphoresis of spherical particles is therefore $1/4\pi$ in agreement with Smoluchowski and contrary to Hückel. F. R. G.

Electrophoretic technique. I. Electrophoresis of hæmocyanins. A. Tiselius and F. L. Horsfall, jun. (Arkiv Kemi, Min., Geol., 1939, **13**, **A**, No. 18, 20 pp.).—Using the hæmocyanins of *Helix pomatia* and *H. nemoralis*, electrophoretic diagrams obtained by the multiple scale method have been employed to study the accuracy with which mobility determinations can be repeated, changes of mobility as a result of dissociation and reassociation, the accuracy with which the concn. of various components can be estimated, the asymmetry of the migrating boundaries, and reversible spreading of the boundaries. The two hæmocyanins probably exist in a no. of forms having the same mol. wt. but slightly different electrophoretic properties. T. H. G.

Action of ionising radiations on electrophoretic mobility of colloid particles. J. A. Crowther, H. Liebmann, and R. Jones (Phil. Mag., 1940, [vii], **29**, 391—399; cf. A., 1939, I, 470).—The effect of γ-rays and of Mo *K* and Se *K* *X*-rays on the electrophoretic mobility, *u*, of colloidal particles of Au of definite size has been investigated. D_n, the radiation dose required to bring the solution to the *n*th turning point, max. or min., in the curve of *u* against dose, $= k^n$, where *k* is a const. of mean val. 1·82, independent of particle size. This rule is obeyed by graphite sols illuminated with Mo *K*-radiation ($k = 1·77$). The ratio of the energies absorbed in producing a given

change in u, measured for Au sols illuminated with Mo K- and Se K-radiation, is I·58, or approx. the ratio of the λλ of the radiations. O. D. S.

Interpretation of simple electrophoretic patterns. L. G. LONGSWORTH and D. A. MACINNES (J. Amer. Chem. Soc., 1940, 62, 705—711).—Electrophoretic experiments, using the moving boundary method, have been made on ovalbumin at 0°. Changes in concn. during electrophoresis are computed from "electrophoretic patterns" obtained by recording refractive index gradients (A., 1937, I, 305), using the scanning method (A., 1939, I, 222). The nature of the δ and ε boundaries and the distribution of protein concn. in the rising and descending boundaries have been examined. Only the falling boundary gives the correct mobility vals. The mobilities are almost unchanged by varying protein concn., and gradients of buffer concn. exist in all boundaries. W. R. A.

Physical-chemical analysis. N. S. KURNAKOV and M. A. KLOTSCHKO (Compt. rend. Acad. Sci. U.R.S.S., 1939, 25, 383—386).—Tho problem of the dependence of properties of chemical systems on their equilibrium conditions has been investigated. The general principles applying to curves expressing this dependence are considered. It is possible to recognise certain common features in the curves. A. J. M.

Raman study of alcohol association. L. BRÜLL, J. ERRERA, and H. SACK (Rec. trav. chim., 1940, 59, 284—288).—The Raman effect in C_6H_{14} solutions of EtOH has been investigated. As the concn. of EtOH is increased a band at 3370 cm.$^{-1}$ (multimol.) becomes more pronounced, whilst the intensity of a band at 3640 cm.$^{-1}$ (unimol.) remains const. at all EtOH concns. Both bands are absent in pure C_6H_{14}. The data, together with similar data obtained in the near infra-red, indicate that association of EtOH increases with increase in concn. The ratio of associated to non-associated mols. in 5% EtOH is probably $\nless$7. C. R. H.

Spectrographic researches on molecular compounds between organic molecules in solution. I. β-Carotene and deoxycholic acid in a mixed solvent containing ethyl alcohol and carbon tetrachloride in the ratio 2 : 1. G. MILAZZO and G. GIACOMELLO (Gazzetta, 1940, 70, 73—86).—Measurements of the absorption spectra in the region 2500—5500 A. of mixtures of β-carotene (I) and deoxycholic acid (II) in a 2 : 1 mixture of EtOH and CCl_4 show that a 1 : 1 compound between (I) and (II) is formed. The dissociation const. is $\sim 1 \times 10^{-3}$. O. J. W.

Ionisation constants of weak acids at 25° from conductance measurements. Method of extrapolating data. B. SAXTON and L. S. DARKEN (J. Amer. Chem. Soc., 1940, 62, 846—852).—Thermodynamic ionisation consts. measured at 25° by the conductance method are $CN{\cdot}CH_2{\cdot}CO_2H$ $3{\cdot}360 \times 10^{-3}$, HCO_2H $1{\cdot}825 \times 10^{-4}$, and Pr^aCO_2H $1{\cdot}518 \times 10^{-5}$. W. R. A.

Dissociation of acetic, glycollic, and malonic acids in glycerol–water mixtures. B. ADELL (Z. physikal. Chem., 1940, 186, 27—53; cf. A., 1940, I, 116).—The concn. dissociation consts. (K_g or K'_g and K''_g) for AcOH, $OH{\cdot}CH_2{\cdot}CO_2H$ (I), and $CH_2(CO_2H)_2$ (II), in a series of glycerol (III)–H_2O mixtures at ionic strengths (μ) $\ngtr$3·01, and by extrapolation the corresponding vals. (K_0 etc.) for $\mu = 0$, have been determined. By comparison with the thermodynamic dissociation consts. (K_a etc.) the activity functions $\phi_g = K_a/K_g$ are evaluated, and log ϕ_g/ϕ (where ϕ is the activity function for H_2O solution at the same μ) is used as a measure of the medium effect due to (III). At const. μ, log ϕ_g/ϕ is $\propto$ [(III)], except for AcOH, for which log $\phi_g/\phi = k_1[(III)] + k_2[(III)]^2$. At const. [(III)], log ϕ_g/ϕ for AcOH has a min. at $\mu \sim 0{\cdot}15$, and log ϕ'_g/ϕ' and log ϕ''_g/ϕ'' for (II) have min. at $\mu \sim 0{\cdot}35$ and $\mu \sim 2{\cdot}0$ respectively. pK is a linear function of $1/D$, where D is the dielectric const. The results are discussed in terms of current theories. F. J. G.

Ionisation constants and hydrolytic degradations of cyameluric and hydromelonic acids.— See A., 1940, II, 110.

Temperature-dependence of the dissociation constant of deuteroacetic acid. F. BRESCIA, V. K. LAMER, and F. C. NACHOD (J. Amer. Chem. Soc., 1940, 62, 614—617).—From the equiv. conductivities of NaCl, NaOAc, HCl, and AcOH, measured at 14·36°, 25°, 35°, and 44·86° in a solvent of D-fraction 0·925, the dissociation const. K_D of AcOD has been calc. at the corresponding temp. K_D follows a Harned–Embree type of equation (A., 1934, 732), viz., $-\log K_{D,\theta} = 4{\cdot}5 \times 10^{-5}(\theta - 31{\cdot}06) + 5{\cdot}2550$, and passes through a max. at 31·06° (22° for AcOH). The ratio K_H/K_D decreases with increasing temp. The differences in the heat contents, free energies, and entropies of ionisation of AcOD and AcOH have been calc. ΔC_p for the exchange process AcOH (H_2O) + D˙ (D_2O) + OAc′ (D_2O) = AcOD (D_2O) + H˙ (H_2O) + OAc′ (H_2O) is practically zero; ΔS is approx. const. at —1·3 g.-cal. per degree per mol. W. R. A.

Effect of variation in ionic strength and temperature on the apparent dissociation constants of thirty substituted barbituric acids. M. E. KRAHL (J. Physical Chem., 1940, 44, 449—463).—The effect of NaCl concn. on the dissociation consts. (K') of 30 substituted barbituric acids has been determined at 25° by p_H measurements using a glass electrode. For [NaCl] < 2M. K' varies approx. in accord with the modified Debye–Hückel equation $-\log\gamma_{A^-} = A\sqrt{\mu}/(1 + Ba\sqrt{\mu})$, where a is an empirical const. dependent on the nature of the anion. The thermodynamic dissociation consts. (K) at 25° have been calc. by this equation. The effects of temp. on K' and K for 5-ethyl-5-*iso*amylbarbituric acid have been determined at 15—40° and the vals. of $\Delta G°$ calc. For this temp. range $\Delta S°$ is —3·1 g.-cal. per degree. An equation is derived whereby the vals. of K' for the 30 compounds can be calc. for any ionic strength and at any temp. within the physiological range. J. W. S.

Vapour–liquid equilibrium. V. Carbon tetrachloride–benzene mixtures. G. SCATCHARD, S. E. WOOD, and J. M. MOCHEL (J. Amer. Chem. Soc., 1940, 62, 712—716).—The system CCl_4–C_6H_6 has been investigated over the entire range at 40° and 70° and

for equimol. mixtures at 30°, 50°, and 60°. ρ at 25° has also been measured. The equations derived for the thermodynamic functions are slightly asymmetric.
W. R. A.

Vapour pressure of ammonia over fused zinc chloride ammoniate. A. Z. KRASNOV (J. Appl. Chem. Russ., 1939, **12**, 1595—1597).—The v.p. of NH_3 over fused $ZnCl_2,NH_3$ at 400—483° is given by $\log P = \log x + (\alpha_0 + \alpha_1 x + \alpha_2 x^2) \log e$, where x is the concn. of NH_3 in the liquid phase, and α_0, α_1, and α_2 are complicated functions of temp. R. T.

Convergence of tie lines in ternary liquid systems. I. BACHMAN (J. Physical Chem., 1940, **44**, 446—449; cf. A., 1939, I, 313).—It is shown that, when less conc. solutions are concerned, the lines connecting the compositions of conjugated solutions on ternary liquid diagrams have no common focal point. J. W. S.

Azeotropic system ethyl alcohol–water–benzene. W. D. BONNER and M. B. WILLIAMS (J. Physical Chem., 1940, **44**, 404—408).—The compositions of the two liquid layers formed in the product from the distillation of $EtOH-H_2O-C_6H_6$ mixtures at 160—960 mm. have been investigated by refractive index measurements. The proportion of H_2O in the heavier phase increases rapidly with increasing pressure $<$600 mm., but the effect is small at $>$1 atm., and therefore the advantage of increased pressure in this process of dehydrating EtOH becomes slight.
J. W. S.

System mercuric iodide–rubidium iodide–water. (MLLE.) M. PERNOT (Compt. rend., 1940, **210**, 603—605; cf. A., 1938, I, 252; Grossmann, A., 1904, ii, 406).—The system has been studied by the Schreinemakers method at 34°. The stable solid phases are HgI_2, RbI, and the *double salts* RbI,HgI_2,H_2O and $5RbI,3HgI_2$. A. J. E. W.

Ternary systems. XXIV. Solid solutions of alums at 25°. A. E. HILL, N. O. SMITH, and J. E. RICCI (J. Amer. Chem. Soc., 1940, **62**, 858—866).—The isotherm at 25° for the system $Tl_2SO_4-Al_2(SO_4)_3-H_2O$ consists of the three solubility curves of Tl_2SO_4, $TlAl(SO_4)_2,12H_2O$, and $Al_2(SO_4)_3,nH_2O$. The solubility of $Tl_2SO_4 = 5{\cdot}213\%$ and that of $Al_2(SO_4)_3,nH_2O = 27{\cdot}86\%$. A complete series of solid solutions is found in the ternary systems, $TlAl(SO_4)_2-NH_4Al(SO_4)_2-H_2O$, $TlAl(SO_4)_2-KAl(SO_4)_2-H_2O$, $NH_4Cr(SO_4)_2-KCr(SO_4)_2-H_2O$. At 25° the solubility of $TlAl(SO_4)_2$ is 6·989%, of $NH_4Al(SO_4)_2$ 6·15%, and of $KAl(SO_4)_2$ 6·58%. For the system $NH_4Fe(SO_4)_2-KAl(SO_4)_2-H_2O$ investigations have been made in the region where the compositions are representable in terms of $NH_4Fe(SO_4)_2$, $KAl(SO_4)_2$, and H_2O. It behaves as a system of $>$ four components when the concn. of $KAl(SO_4)_2$ is large relatively to the concn. of $NH_4Fe(SO_4)_2$, but all the quaternary solids are solid solutions of alums. W. R. A.

Systems $MnO-TiO_2$ and $MnO-FeO-TiO_2$. J. GRIEVE and J. WHITE (J. Roy. Tech. Coll., 1940, **4**, 660—670; cf. A., 1939, I, 322).—Thermal equilibrium diagrams have been determined. The binary system has MnO,TiO_2 (incongruent m.p.) and $2MnO,TiO_2$. In the ternary system a complete series of mixed crystals is given by MnO,TiO_2 and FeO,TiO_2 and by $2MnO,TiO_2$ and $2FeO,TiO_2$, and a limited series by MnO and FeO. Diagrams and photomicrographs are given.
F. L. U.

Equilibrium in the system calcium oxide–phosphorus pentoxide–water. K. L. ELMORE and T. D. FARR (Ind. Eng. Chem., 1940, **32**, 580—586).—Equilibrium data, and vals. of ρ for the saturated solution, of Ca phosphates in 2—98% aq. H_3PO_4 at 25—100° are given. There is no evidence of solid solution. The solubility product of Ca_2HPO_4 is $3{\cdot}3 \times 10^{-7}$. F. J. G.

Direction of crystallisation in quaternary systems. T. A. POPOVA (J. Phys. Chem. Russ., 1939, **13**, 826—828; cf. A., 1937, I, 138).—The calculation from temp. data for the liquidus surface is described. R. C.

Quaternary system calcium hypochlorite–calcium chloride–calcium hydroxide–water. J. OURISSON (Atti X Congr. Internaz. Chim., 1938, IV, 40—50).—Equilibrium diagrams at 10°, 30°, 40°, and, in greater detail, at 20° are given and discussed with special reference to the formation of $3Ca(OCl)_2,2Ca(OH)_2,2H_2O$ (cf. B., 1937, 1044).
F. O. H.

Osmotic pressure, heat of dilution, and entropy of dilution. G. V. SCHULZ (Z. physikal. Chem., 1939, **45, B**, 110—115).—A reply to Boissonnas and Meyer (cf. A., 1938, I, 400). W. R. A.

Osmotic pressure and mol. wt. of serum-albumin and -globulin of selachians and cyclostomes.—See A., 1940, III, 530.

Specific heats of aqueous sodium and potassium chloride solutions at several temperatures. I. C. B. HESS and B. E. GRAMKEE. **II.** C. M. WHITE (J. Physical Chem., 1940, **44**, 483—494, 494—512).—I. A modified twin calorimeter has been used to determine the sp. heats of 0·01—0·1M-NaCl and -KCl at 15°, 25°, 35°, and 45°.

II. The sp. heats of 0·01—0·2M-NaCl have been determined at 35°, 38°, 41°, and 45°. At each temp. the apparent mol. heat capacity is a linear function of $m^{0\cdot5}$ (m = mol. concn.). Empirical equations are derived to express the apparent mol. heat capacities of both NaCl and KCl solutions. The relative partial mol. heat contents at several temp. are calc. by the Person–Kirchhoff equation. J. W. S.

Conductometric behaviour of potassium chloride solutions. M. M. JACOPETTI (Gazzetta, 1940, **70**, 95—109).—Measurements of η and Λ for 1·0—4·0M-KCl at 18° to 70° have been made. The fraction of free ions in the solutions is calc. from Ghosh's theory. O. J. W.

Maxima on current–voltage curves. B. BRUNS, A. FRUMKIN, S. JOFA, L. VANJUKOVA, and S. ZOLOTAREVSKAJA (J. Phys. Chem. Russ., 1939, **13**, 786—793; cf. A., 1935, 1079; 1939, I, 148).—The max. are traced to mixing of the Hg by surface movements caused by differences of surface tension between various parts of the surface and by variations of surface tension with time. R. C.

Electrode potential of crystal surfaces of metals. I. Zinc. M. SATÔ and K. MARUYAMA

(Sci. Rep. Tôhoku, 1940, **28**, 386—397).—The electrode potentials of polycryst. rods and sublimed crystals of Zn in aq. HCl have been measured and the variations with time followed. From the method of prep. of the electrodes it is deduced that the initial vals. for the rods correspond with the potential of the (10$\bar{1}$0) and for the sublimed crystals with that of the (0001) crystal surface. The final val. in each case is that for the most stable, (11$\bar{2}$1), surface. Normal potentials at 25° are ($E_H = 0$) (0001) 870, (10$\bar{1}$0) 851, (11$\bar{2}$1) 809 mv. and agree with the vals. of Straumanis for single cryst. Zn in aq. H_2SO_4 (A., 1930, 705).
O. D. S.

Mutual polarity of silver and nickel in aqueous potassium iodide. E. Toporescu (Compt. rend., 1940, **210**, 602—603).—The reversal of the normal relative polarity of Ag and Ni and the increased p.d. between Ag and Pt in aq. KI (cf. A., 1938, I, 402) are due to replacement of K by Ag, with deposition of K on the Ag plate. This replacement is confirmed analytically. A. J. E. W.

Periodic oscillations of the potential of tin in contact with HCl–CrO_3 solutions. II. G. Ehrensvärd, M. Karschulin, and I. Ehrensvärd (Arkiv Kemi, Min., Geol., 1939, **13**, **A**, No. 20, 11 pp.; cf. A., 1939, I, 83).—The frequencies of the oscillating potentials developed by Sn in HCl–CrO_3 solutions have been measured with the cathode-ray oscillograph. Three typical regions have been recognised. The first and second of these are characterised by a slow oscillation of the e.m.f. between approx. −100 and −150 mv. on the H scale at fairly low and at higher concns. of CrO_3, respectively, and the third by a high frequency oscillation between 250 and 350 mv. at high (6—7·6M.) concn. of CrO_3. The frequency in the third region varies with the concns. of both HCl and CrO_3 and reaches vals. as high as 250 vibrations per sec. These frequencies are $\gg$ any recorded previously in similar systems. The properties of the system Sn–HCl–CrO_3 resemble the phenomena resulting from nerve stimulation more closely than do those of the system Fe–H_2SO_4–CrO_3 suggested by Lillie. T. H. G.

Mercurous bromide electrode. W. D. Larson (J. Amer. Chem. Soc., 1940, **62**, 764—765).—The e.m.f. of the cell Ag|AgBr, KBr, Hg_2Br_2|Hg has been measured at 20°, 25°, and 30°. The standard potential of the Hg|Hg_2Br_2 electrode at 25° is 0·1397 v. S_0 for Hg_2Br_2, evaluated from the temp. coeff., is 48·7 g.-cal. per degree per mol. W. R. A.

Theory of galvanic cells subject to fields of force. I. Gravitational field. F. O. Koenig and S. W. Grinnell (J. Physical Chem., 1940, **44**, 463—482).—From the condition for quasi-reversible conduction (A., 1940, I, 165) general equations are derived to express the e.m.f. of a cell subject to gradients of gravitational potential (g) and of the mol. fractions as a function of the chemical state at each point and the configuration. When $g = 0$ these equations become the general equations of cells with liquid–liquid junctions. The p.d. in a cell subject to a gravitational field is calc. as a function of chemical state and configuration and is shown to be thermodynamically indeterminate. J. W. S.

Photo-voltaic cells with silver–silver bromide electrodes. III. Optical sensitising by dyes. S. E. Sheppard, W. Vanselow, and G. P. Happ (J. Physical Chem., 1940, **44**, 411—421; cf. A., 1939, I, 315, 480).—The effect of a cyanine dye on the photopotential changes occurring during the first sec. of illumination in cells with Ag|AgBr electrodes in various electrolytes has been recorded photographically (cf. A., 1929, 1242). The dye causes an optical sensitisation of the primary electronegative (photoelectronic) effect and light absorbed by the dye but not by the AgBr produces relatively large photocurrents. The dye also acts as a Br-acceptor, thereby decreasing the positive effect. These results are in accord with observations of the photo-decomp. of dyed AgBr. They confirm that the photo-electric effect can be analysed into an initial effect produced by photo-electrons released from the AgBr passing to the metal, and a slow reaction of Br with Ag, producing an e.m.f. which opposes the primary effect. The mechanism of the sensitisation is discussed.
J. W. S.

Oxidation–reduction potential of vitamin-K_1 B. Riegel, P. G. Smith, and C. E. Schweitzer (J. Amer. Chem. Soc., 1940, **62**, 992).—The oxidation–reduction potential of pure synthetic vitamin-K_1, determined in 3% solution, is 363 mv. at 20°. In conjunction with C–H and absorption spectrum analyses this val. indicates that the vitamin is a 2 : 3-dialkyl-1 : 4-naphthaquinone. W. R. A.

Behaviour of cathode-polarised iron in nitric acid. M. Karschulin (Atti X Congr. Internaz. Chim., 1938, IV, 371—380).—Measurements of c.d.–p.d. were made on Fe in 14·5, 11·6, and 9·2N-HNO_3. Strongly positive p.d. in absence of current corresponded with the passive state of the Fe. The course of the c.d.–p.d. curve for cathode-polarised Fe was const. up to vals. of 0·3 ma. per sq. cm. and then showed periodic variations in p.d. and c.d., the amplitude and frequency of which were dependent on c.d. and [HNO_3]. C.d. of 250—750 ma. per sq. cm. corresponded with a negative p.d. Variations in p.d. with decreased cathode polarisation are described. The reduction of HNO_3 to HNO_2 or, alternatively, formation of H_2 from $H^\cdot$ is analogous to the reaction at a Pt cathode (Ellingham, A., 1932, 705).
F. O. H.

Polarographic study of reduction of chromate ion at the dropping mercury electrode. J. J. Lingane and I. M. Kolthoff (J. Amer. Chem. Soc., 1940, **62**, 852—858).—The reduction of CrO_4'' at the dropping Hg electrode has been investigated polarographically (A., 1939, I, 325) in buffered and unbuffered solutions, and in strongly alkaline media. In unbuffered solutions of K_2CrO_4, with KCl as supporting electrolyte, the current–voltage curve of K_2CrO_4 consists of three waves. Addition of 0·2N-NaOH eliminates the first and third, but leaves the second, at −1·0 v. Curves are also given for K_2CrO_4 in N-NaOH, and only one wave is obtained, with a const. half-wave potential independent of [K_2CrO_4]; the diffusion current is $\propto$ [CrO_4''], and shows that in alkaline media CrO_4'' is reduced to Cr^{III}. In un-

buffered KCl solutions the current–voltage curve has four waves, the last three corresponding respectively with $CrO_4'' \rightarrow Cr^{III}$, $CrO_4'' \rightarrow Cr^{II}$, and $CrO_4'' \rightarrow Cr$. Study of the first wave, at $-0{\cdot}3$ v., shows it to be due to the formation of a film (stable at p_H 10·5 to 13·5) of $Cr(OH)_3$ or basic chromic chromate at the electrode surface, this film preventing further reduction. The behaviour in buffered solutions of various p_H range has been investigated and the film of basic salt is stable only within the range p_H 10·5—13·5. N-NaOH is the most suitable supporting electrolyte for the polarographic determination of chromate.

W. R. A.

Lead electrode. II. Capacity of double layer and measurement of true surface. B. Kabanov and R. Judkevitsch (J. Phys. Chem. Russ., 1939, **13**, 813—817; cf. A., 1940, I, 28).—A method of finding the true surface area of Pb electrodes by measuring the capacity, *C*, of the double layer with a const. current is described. Surface-active org. substances depress *C* considerably. R. C.

Brownian motion in a field of force and the diffusion model of chemical reactions. H. A. Kramers (Physica, 1940, **7**, 284—304).—The applicability of the transition state method in calculating the rate of chemical reactions is examined by considering the escape of a particle from a potential hole over a potential barrier through the effect of Brownian motion. L. J. J.

Temperature distribution in reaction vessel, and stationary theory of thermal explosion. D. A. Frank-Kamenetzki (J. Phys. Chem. Russ., 1939, **13**, 738—755).—By mathematical analysis of the mechanism of heat loss in a gas mixture it has been possible to devise a method of calculating the inflammation limit from the kinetics and heat effect of the reaction, the thermal conductivity of the gas mixture, and the dimensions of the vessel. The results agree generally with existing experimental data. R. C.

Elimination and metathetical reactions and the electronic theory of rearrangements.—See A., 1940, II, 201.

Thermal explosion of diethyl peroxide. E. J. Harris (Proc. Roy. Soc., 1940, **A**, **175**, 254—261).—The crit. explosion pressure has been measured in vessels of different dimensions, the conditions determining the explosion being found to be in agreement with those predicted by the thermal theory. The effect of the addition of H_2 and He was investigated. The behaviour of Et_2O_2 is shown to be similar to that of Me_2N_2 and EtN_3. G. D. P.

Thermal decomposition of diacetyl. W. D. Walters (J. Amer. Chem. Soc., 1940, **62**, 880—886).—The kinetics of the decomp. of Ac_2 at various temp. between 383° and 436° have been investigated. Undecomposed Ac_2 was determined by conversion into dimethylglyoxime and pptn. with a Ni salt. Pressure increases, corresponding with different amounts of decomp., have been measured. Although the reaction is of first order ($k = 8{\cdot}7 \times 10^{15}e^{-63,200/RT}$ per sec.) with variation of the initial pressure, the first-order coeff. falls during a run. Keten increases as the % decomp. decreases. C_3H_8 retards the decomp. A chain mechanism is postulated.

W. R. A.

Thermal decomposition of gaseous benzaldehyde. R. E. Smith and C. N. Hinshelwood (Proc. Roy. Soc., 1940, **A**, **175**, 131—142).—The predominant reaction is $PhCHO \rightarrow C_6H_6 + CO$; it is homogeneous of the first order above 100 mm. pressure and subject to partial inhibition by NO. The activation energy increases as the pressure decreases. The results are explained by the superposition of a chain reaction and a mol. reaction in which the decomp. of the radical CHO is an essential step. G. D. P.

Primary reaction in the thermal polymerisation of styrene. (A) J. W. Breitenbrach. (B) G. V. Schulz, A. Dinglinger, and E. Husemann (Z. physikal. Chem., 1939, **45**, **B**, 101—104, 105—109).—Polemical (cf. Schulz *et al.* A., 1939, I, 526). W. R. A.

Oxidation of tetrahydronaphthalene in condensed phase. S. Medvedev and A. Podjapolskaja (J. Phys. Chem. Russ., 1939, **13**, 719—737; cf. A., 1939, I, 149).—Oxidation by O_2 at 65—95° yields chiefly tetralin H peroxide (I) and tetralone (II); no acids or aldehydes are formed. (I) accelerates the reaction, whilst (II), which is formed by the decomp. of (I), retards, by an amount which rises and then becomes const. as the concn. of (II) increases. The oxidation can be resolved into two independent stationary chain reactions. One arises from the thermal activation of tetralin, is retarded by (II), and proceeds by a mechanism similar to that of the oxidation of MeCHO (A., 1931, 572), and the second depends on the decomp. of a compound formed on the wall by collision of a (I) mol. with an adsorbed (II) mol., and is accelerated by (II). Both reactions lead to the accumulation in the system of (I), which gives the oxidation an autocatalytic character. R. C.

Alkaline hydrolysis of the sulphur chlorides (S_2Cl_2 and SCl_2) in alcoholic solution. G. Holst (Bull. Soc. chim., 1940, [v], **7**, 276—278).—The hydrolysis of S_2Cl_2 and SCl_2 (*x* mols.) by KOH in 95% EtOH is accompanied by the immediate neutralisation of 2*x* mols. of KOH, followed by the slow neutralisation of a further 2*x* mols. of KOH. In 99% EtOH the hydrolysis stops almost completely when 2*x* mols. of KOH are neutralised. The rapid reaction is attributed to the formation of $S_2(OH)_2$ and $S(OH)_2$, respectively, and the slow reaction to the further hydrolysis of these compounds.

J. W. S.

Chain polymerisation of styrene in solution. Polymerisation of styrene in heavy alcohol. T. Titani and T. Yosida (Proc. Imp. Acad. Tokyo, 1940, **16**, 33—35).—The H_2O resulting from combustion of polystyrene (I) produced by polymerisation in EtOD has a D content < would correspond with exchange of one H per mol. of (I). That this D content is not due to exchange, but to inclusion of solvent by (I), is further shown by the fact that a similar result is obtained after polymerisation in $C_2H_4D{\cdot}OH$. Accordingly no stage of the polymeris-

ation, including the chain-breaking step, involves a loosening or migration of H such as would lead to an exchange reaction. F. J. G.

Kinetics of addition of hypochlorous acid to double linkings. V. Formation of αβ-dichloroethane from ethylene and hypochlorous acid at low hydrochloric acid concentrations. E. A. SCHILOV, S. N. SOLODUSCHENKOV, and A. N. KURAKIN (J. Phys. Chem. Russ., 1939, **13**, 759—766; cf. A., 1938, I, 36).—In aq. HCl C_2H_4 and Cl_2 react to form $(CH_2Cl)_2$ (I) and $Cl\cdot[CH_2]_2\cdot OH$ (II). If [HCl] is $\not>0\cdot006$M. the amount of (I) formed is 3·4 mol.-% of that of (II), independent of [HCl]. A similar relation is true for the formation of the chloro-alcohol and dichloride in the reaction of Cl_2 with allyl alcohol. It is inferred that there is a mode of formation of (I) from C_2H_4 and Cl_2 which does not involve the participation of Cl′ ions or the direct, non-catalysed union of Cl_2 to the double linking. R. C.

Relative velocity of chloralkoxylation of olefines. II. V. A. SKLJAROV (J. Appl. Chem. Russ., 1939, **12**, 1835—1839; cf. A., 1940, II, 150).—The velocity of the reaction olefine + EtOCl → chloroether rises in the order $C_2H_4 < CH_2{:}CHMe < (CHMe{:})_2 < CH_2{:}CMe_2 < CHMe{:}CHEt$. That of the reaction chloroamine + EtOH → EtOCl rises in the order $NHAcCl < CO(NHCl)_2 < PhSO_2\cdot NCl_2$. R. T.

Reaction of alkyl halides with hydrogen halides and decomposition of methyl bromide.—See A., 1940, II, 147.

Kinetics of decomposition of carbamide in aqueous solution. A. I. KRASILSCHTSCHIKOV (J. Phys. Chem. Russ., 1939, **13**, 767—770).—The reaction at 50—100° is unimol., the velocity coeff. rising slightly with the initial dilution. The energy of activation is 28,400 g.-cal. R. C.

Exchange reaction of the hydrogen atoms of the nucleus of aniline hydrochloride in aqueous solutions. III. Activation energy. M. KOIZUMI (Bull. Chem. Soc. Japan, 1940, **15**, 37—46; cf. A., 1940, I, 30).—The rate of the stoicheiometric reaction $NH_3PhCl + HDO = C_6H_4D\cdot NH_3Cl + H_2O$ is given by $\log k = 11\cdot6 - 29{,}500/4\cdot574T$ l. mol.$^{-1}$ sec.$^{-1}$ For the true reaction, $NH_2Ph + H_2DO^{\cdot} = C_6H_4D\cdot NH_2 + H_3O^{\cdot}$, $\log k = 9\cdot7 - 20{,}800/4\cdot574T$ l. mol.$^{-1}$ sec.$^{-1}$ Consideration of analogous reactions would lead to the expectation of a greater activation energy, and possible causes of the discrepancy are discussed. In reactions of this type the steric factor is determined mainly by the structure of the deuterating agent and the energy of activation by that of the mol. to be deuterated. F. J. G.

Kinetics of bromination of α-phenylsulphonylpropionic acid in aqueous solution. L. RAMBERG and I. HEDLUND (Arkiv Kemi, Min., Geol., 1939, **13**, **A**, No. 17, 34 pp.).—The bromination proceeds as a reversible unimol. conversion of the $PhSO_2\cdot CHMe\cdot CO_2H$ (I) into an active modification (II) which then reacts with the Br in an irreversible bimol. change giving $PhSO_2\cdot CBrMe\cdot CO_2H$ (III). The velocity coeff. of the activation process is identical with the racemisation coeff. and depends on the properties of the medium, and, in solutions containing concns. of mineral acid $\geqslant 0\cdot1$N., depends on the nature and concn. of the inorg. anions. This reaction is a combination of four simultaneous changes, among which one involving undissociated mols. of (I) as reactant and H_2O as a basic catalyst predominates. The concn. of (II) is $<0\cdot0002$ of that of (I). Both Br_2 and Br_3' are concerned in the change (II) → (III), tho Br_2 reacting five times as rapidly with (II) as the Br_3'. In this process (II) reacts exclusively or at least predominantly as neutral mols. Under high [Br] the complete reaction (I) → (III) is entirely unimol., but at very much lower [Br] it is bimol. Racemisation is always more rapid than bromination but they become more nearly equal as [Br] increases. T. H. G.

Kinetics of decarboxylation in solution. P. JOHNSON and E. A. MOELWYN-HUGHES (Proc. Roy. Soc., 1940, **A**, **175**, 118—131).—The decomp. of $CCl_3\cdot CO_2H$, $CBr_3\cdot CO_2H$ and $C_6H_2(NO_2)_3\cdot CO_2H$ in aq. solution was investigated over a wide range of temp. To represent the results the Arrhenius equation must be modified by the addition of a term of the form $b \log T$. The consts. in the equation are deduced, and the kinetics of reactions in solution are discussed. G. D. P.

Hydrolysis of fats and fatty acid esters. VII. T. ONO (J. Agric. Chem. Soc. Japan, 1940, **16**, 197–205).—The rate of hydrolysis of tri-, di-, and monoglycerides of stearic, palmitic, and oleic acids increases in the order tri-, di-, and mono-glycerides in homogeneous and heterogeneous systems. The ratio reaction velocity coeff. of mono- : tri-stearin is > that of mono- : tri-olein. Mixed triglycerides such as α-oleo- and β-moructo-distearin (I) are hydrolysed more rapidly than are simple triglycerides. The fatty acid radicals in the α- and β-positions in (I) are hydrolysed at the same rate in homogeneous system but in heterogeneous system moroctic acid in the β- is hydrolysed more rapidly than is that in the α-position. In homogeneous system there is no difference in the rates of hydrolysis of α- and β-oleostearin. J. N. A.

Hydrolysis of fats and fatty acid esters. VI. See A., 1940, III, 533.

Decomposition of fructose with acid. Determination of reaction constant at high temperature.—See A., 1940, II, 206.

Diffusion theory of heterogeneous reactions. D. A. FRANK-KAMENETZKI (J. Phys. Chem. Russ., 1939, **13**, 756—758).—The kinetics of heterogeneous reactions are worked out for the case where the rate of reaction at the interface and the rate of diffusion of reactants to the interface are comparable in magnitude. R. C.

Action of carbon monoxide on ammoniacal solutions of cupric salts. III. Absorption of carbon monoxide in different cupriammine solutions having the same concentration of copper. IV. Absorption of carbon monoxide in solutions of cupriammine salts at different concentrations of copper and in solutions of cupriammine salts with oxidising anions. H. MÖLLER and K. LESCHEWSKI (Z. anorg. Chem.,

1940, **243**, 330—345, 346—354).—III. The effect of the anion on the rate of absorption of CO by ammoniacal solutions of Cu^{II} salts at a fixed concn. of Cu has been studied. In general the initial rate is least for salts of strong acids, greater for those of weak acids, and greater still for the hydroxide, suggesting that in all cases the effective agent is undissociated $[Cu(NH_3)_x](OH)_2$ resulting from hydrolysis. Detailed results are discussed and compared with thermochemical data and ionic radii and deformabilities.

IV. The initial rate of absorption of CO by ammoniacal solutions of Cu^{II} salts increases at first with increasing [Cu], but decreases again at high [Cu]. The latter effect is attributed to decreased degree of dissociation and consequently decreased hydrolysis (see above), and also to increased viscosity. In IO_3' solutions the anion is only slightly, and in ClO_3' and ClO_4' solutions not at all, reduced by CO or metallic Cu. F. J. G.

Unification of data on the kinetics of cracking of hydrocarbons. M. D. TILITSCHEEV (J. Appl. Chem. Russ., 1939, **12**, 1808—1815).—The static method is preferred to the dynamic one. R. T.

Kinetics of polymerisation of butadiene in presence of metallic sodium. A. ABKIN and S. MEDVEDEV (J. Phys. Chem. Russ., 1939, **13**, 705—718).—An earlier paper (A., 1936, 296) is amplified. Polymerisation is not confined to the surface of the polymeride but proceeds throughout it. The sorption of butadiene by the polymeride has been examined at 30—60°; the order of the polymerisation reaction varies with temp. between 1 and 2, corresponding with variations in the index of the sorption isotherm. The relation between the rate of polymerisation and the rate of diffusion of the monomeride in the polymeride has been established, and vals. of the diffusion coeff. and energy of activation have been calc. R. C.

Kinetics of carbide dissolution in hypoeutectoid plain carbon and low alloy steels.—See B., 1940, 363.

Sensitisation of the hydrogen–oxygen reaction by nitrous oxide. C. J. DANBY and C. N. HINSHELWOOD (J.C.S., 1940, 464—468).—When N_2O is added to a H_2–O_2 mixture at 550°, it behaves as an inert gas; its effect on the explosion limit is similar to that of CO_2. On the other hand addition of O_2 to a H_2–N_2O mixture at 550° results in either immediate explosion or an autocatalytic reaction leading to explosion. The explosion is hastened by increasing $[H_2]$ or $[N_2O]$, or the time during which they have been in contact, and also by decreasing $[O_2]$. The H_2 and N_2O react to form a sensitiser which is present in the bulk of the gas, not on the walls, and must be NO. It is removed by $FeSO_4$, and the amount is too small for detection by $NHPh_2$. The mechanism is $N_2O + H_2 = N_2 + OH + H$; $H + N_2O = N_2 + OH$; $OH + H_2 = H_2O + H$; $N_2O + H = NO + NH$ (slow). The sensitisation by NH_3 also involves NO. F. J. G.

Thermal decomposition of acetone catalysed by iodine. G. M. GANTZ and W. D. WALTERS (J. Amer. Chem. Soc., 1940, **62**, 996—997).—I or, less well, EtI catalyses the decomp. of $COMe_2$ at 493° or 506° (cf. Bairstow *et al.*, A., 1933, 1125). R. S. C.

Chlorine-induced decomposition of diethyl ether [and of acetaldehyde].—See A., 1940, II, 150.

Heterogeneous catalytic decomposition of hydrogen peroxide in heavy water. P. A. GIGUÈRE and O. MAASS (Canad. J. Res., 1940, **18**, **B**, 84—89).—The rates of decomp. at 30° of H_2O_2 on glass in an alkaline medium and on Au in D_2O have been compared with those in H_2O. D_2O_2 is much more stable than H_2O_2. On Au the two reactions appear to follow different courses, that in H_2O being of zero order and that in D_2O being autocatalytic. F. J. G.

Correlation of adsorption and catalytic activity II. Carbon monoxide and hydrogen adsorption on zinc–chromium catalysts. F. RUMFORD (J. Roy. Tech. Coll., 1940, **4**, 643—649).—Measurements of the adsorption of H_2 (cf. A., 1939, I, 329) and of CO on Zn–Cr catalysts at 300°, 360°, and 400° show that the adsorption of CO decreases rapidly with increasing Zn content and becomes negligibly small at ~80 at.-%. The catalytic activity for the decomp. or synthesis of MeOH is a max. at the composition at which H_2 and CO are adsorbed equally, viz., at ~67 at.-% of Zn. F. L. U.

Magnetism and catalysis. I. Catalytic decomposition of potassium chlorate by manganese dioxide and ferric oxide. II. Catalysis of persulphate and iodide reaction by ferrous ions. S. S. BHATNAGAR, B. PRAKASH, and J. SINGH (J. Indian Chem. Soc., 1940, **17**, 125—132, 133—137).—I. The chemical and magnetic changes in the reactants during the decomp. of $KClO_3$ catalysed by MnO_2 and Fe_2O_3 indicate the formation of an intermediate compound between $KClO_3$ and catalyst. In the case of MnO_2 the intermediate compound is either diamagnetic or at least less strongly paramagnetic than the original MnO_2. The magnetic properties of the compound with Fe_2O_3 may be similar, but the agreement between observed and calc. vals. suggests that the compound is very unstable. Possible reaction mechanisms are discussed.

II. In the reaction between S_2O_8'' and I', catalysed by $Fe^{\cdot\cdot}$, magnetic data indicate the formation of a relatively stable diamagnetic or feebly paramagnetic compound. The formation of $Fe_2(SO_4)_3$ cannot, of itself, account for the increase in reaction velocity. A suggestion is made that the compound is a sixfold complex co-ordination compound of $Fe^{\cdot\cdot}$ having zero magnetic moment. C. R. H.

Catalytic exchange of hydrogen atoms between molecular deuterium and propane and butane. A. FARKAS (Trans. Faraday Soc., 1940, **36**, 522—527).—C_3H_8 and n-C_4H_{10} exchange all their H reversibly when in contact with D_2 and a Pt catalyst; with an active catalyst the exchange occurs readily at room temp. The exchange of C_3H_8 is 4—5 times slower than that of C_4H_{10}, but 36 times faster than that of C_2H_6 (cf. A., 1938, I, 149). The activation energy for C_4H_{10} varies from 26 kg.-

cal. at 26—41° to 11 at 77—95°, and that for C_3H_8 from 12 kg.-cal. at 26—53° to 9 at 97—126°. The mechanism is probably dissociative. F. L. U.

Catalytic exchange of gaseous oxygen. VI. Exchange reaction of the oxygen atoms between oxygen and water vapour at the surfaces of the oxides of the second, fourth, and sixth groups of the periodic system. I. Experimental. N. MORITA (Bull. Chem. Soc. Japan, 1940, **15**, 47—55; cf. A., 1940, I, 225).—Results on the catalysis of the exchange of heavy O between H_2O and O_2 by Mg, Sr, Ba, Zn, Cd, Ti, Zr, Th, Sn, Cr, Mo, and W oxides are recorded in tables. F. J. G.

Catalytic formation of methane from carbon monoxide and hydrogen. VI. Poisoning by carbon deposition. K. M. CHAKRAVARTY (J. Indian Chem. Soc., 1939, **16**, 663—670).—An analysis of the data of Litkenhous and Mann (A., 1937, I, 521) and others shows that the reaction $2CO = C + CO_2$ is catalysed by both Ni and Ni_3C; the reaction $CO + 3H_2 = CH_4 + H_2O$ is accelerated by Ni. Poisoning is due mainly to C adsorbed on the surface, which in the latter reaction is also due to $CO + H_2 = C + H_2O$. F. R. G.

Catalytic toxicity and chemical structure. VI. Poisoning of platinum catalysts by metals. E. B. MAXTED and A. MARSDEN (J.C.S., 1940, 469—474).—The toxic effects of a no. of metallic ions (present as acetates) in the catalytic hydrogenation of crotonic acid by Pt-black have been studied. Cu, Ag, Zn, Cd, Hg, Tl, Sn, Pb, Bi, Mn, Fe, Co, and Ni are toxic, Au, In, and Ti slightly so, and Mg, Be, Al, Zr, Th, Cr, and the alkali and alkaline-earth and rare-earth metals non-toxic. Vals. of true relative toxicity (referred to amount adsorbed) are as follows: Cu, Ag, Sn ~1; Hg 1·7; Tl 2·8; Pb, Fe, Co, Ni, Mn, Zn, Cd, ~4. This suggests a grouping into univalent metals and bivalent metals with toxicities ~1 and ~4. The larger vals. for Hg and Tl may be connected with the larger at. radii, but the val. for Sn is anomalous. F. J. G.

Vapour-phase esterification of benzoic acid with ethyl alcohol: effect of oxides on catalytic activity of silica gel. A. A. VERNON and B. M. BROWN (Ind. Eng. Chem., 1940, **32**, 534—536).—In the esterification of BzOH with EtOH at 370—450°, SiO_2 gel alone has considerable catalytic activity, which is enhanced by ZrO_2, BaO, MnO, and TiO_2, little affected by MgO and Cr_2O_3, and impaired by Al_2O_3, SrO, and BeO. The max. esterification of BzOH was 87%, in presence of TiO_2. F. J. G.

Catalytic dehydrogenation of mono- to di-olefines.—See B., 1940, 342.

Catalytic alkylation of *iso*butane with gaseous olefines.—See B., 1940, 341.

Rate of reaction in the system mineral oil–oxygen and mechanism of the influence of copper and tin on this system.—See B., 1940, 338.

Catalytic hydrogenation of phenolic oil in low-temperature tar.—See B., 1940, 337.

Lower stages of oxidation of ruthenium in hydrochloric acid solution. G. GRUBE and H. NANN (Z. Elektrochem., 1939, **45**, 874—880).—The lower valencies of Ru have been studied by electrolytic reduction of $RuCl_3$ in aq. HCl, followed by potentiometric titration of the reduced solutions with H_2O_2. In 2N-HCl, $Ru^{\cdot\cdot\cdot}$ is reduced simultaneously to $Ru^{\cdot\cdot}$, $Ru^{\cdot}$, and metallic Ru; the formation of $Ru^{\cdot\cdot}$ or $Ru^{\cdot}$ is favoured by higher or lower [HCl], respectively. $Ru^{\cdot\cdot}$ is moderately stable in 2N-HCl, but decomposes ($3Ru^{\cdot\cdot} \rightarrow Ru + 2Ru^{\cdot\cdot\cdot}$) if [HCl] is reduced. $Ru^{\cdot}$ is very unstable; in 0·01M. solution in 0·1N-HCl the reaction $2Ru^{\cdot} \rightarrow Ru + Ru^{\cdot\cdot}$ is complete after 24 hr. The oxidation–reduction potential for $Ru^{\cdot} \rightarrow Ru^{\cdot\cdot}$ in 0·1N-HCl is $\epsilon_H = +0·03—0·05$ v., showing that the reducing action of $Ru^{\cdot}$ is not sufficiently strong to decompose H_2O. A. J. E. W.

Periodic electrolytic depositions of the alloy Zn–Cd from sulphate baths.—See B., 1940, 368.

Electrolysis of higher aliphatic organomagnesium halides in diethyl ether.—See A., 1940, II, 158.

Electrochemical oxidation of *n*-hexanol.—See A., 1940, II, 202.

Cracking of methane in the electric arc at low pressures. II. N. P. BOSHKO (J. Appl. Chem. Russ., 1939, **12**, 1816—1825).—CH_4 decomposes in an electric arc at 30—80 mm. pressure, with production of C_2H_2 and H_2. The yield of C_2H_2 per unit of current at 50—80 mm. is > at 30 mm., but the final $[C_2H_2]$ of the reaction product is smaller. R. T.

Formation of ozone and oxides of nitrogen during certain electrical discharge, and their reaction. II. G. A. GORODETZKI (J. Appl. Chem. Russ., 1939, **12**, 1637—1643).—Silent discharges give rise chiefly to O_3, with ~2% of N_2O_5. Spark discharges give approx. 1 : 2 $NO-NO_2$ mixtures, with $\ngtr$ traces of O_3; in pure O_2, O_3 is formed in very small amount. O_3 does not react with N_2, but it rapidly oxidises NO and NO_2 to N_2O_5. If NO and NO_2 are produced during an electrical discharge it must be assumed that O_3 is not a product of the given reaction. R. T.

Photo-expansion of chlorine: recombination of chlorine atoms. M. RITCHIE and R. L. SMITH (J.C.S., 1940, 394—401).—On illumination of dil. Cl_2 the pressure increases to a max. which is > the steady val., and when the light is cut off the pressure falls to a min. which is < the final "dark" val. The effect is most marked for moderate pressures of diluent, and is attributed to the formation, on illumination, of some species which becomes adsorbed on the walls. A detailed study of the photo-expansion under varying conditions, taking account of diffusion and thermal conductivity, gives results according with the mechanism $Cl + Cl_2 + M = Cl_3 + M$; $2Cl_3 = 3Cl_2$. F. J. G.

(A) Reaction of atomic hydrogen with hydrazine. (B) Photolysis of ammonia. E. A. B. BIRSE and H. W. MELVILLE (Proc. Roy. Soc., 1940, **A, 175**, 164—186, 187—207).—(A) The efficiency of

the reaction has been measured in the temp. range 20—200°. The results show that N_2H_4 is not responsible for the low H atom concn. in the photolysis of NH_3. Although the H atoms react very efficiently with N_2H_4 the quantum efficiency of this reaction is unexpectedly low; an explanation of this result is suggested. It is shown that photodecomp. N_2H_4 converts p-H_2 and it is concluded that the primary decomp. is $N_2H_4 + h\nu = N_2H_3 + H$.

(B) The anomalously low stationary H atom concn. in the photodecomp. of NH_3 is due to inefficiency of the primary process. The efficiency of the primary process is 0·58 for NH_3 and 0·28 for ND_3. A revised scheme for the NH_3 photolysis is given. G. D. P.

Action of ultra-short waves on complex compounds. D. I. ERISTAVI and O. E. ZVJAGINTZEV (Ann. Sect. Platine, 1939, No. 16, 81—86).—The conductivity and temp. of aq. solutions of *cis*-$[Pt(NH_3)_2]Cl_2$, *trans*-$[Pt(NH_3)_2]Br_2$, $[Pt(NH_3)_4]Cl_2$, and $[Co(NH_3)_3(NO_2)_3]$ are raised by exposure to ultra-short waves ($\lambda = 2$—10 m.). Disruption of the mols. is supposed to occur. R. T.

Cadmium-photosensitised reactions of ethylene. E. W. R. STEACIE and R. POTVIN (Canad. J. Res., 1940, **18**, **B**, 47—54; cf. A., 1939, I, 330).—In absence of H_2, the Cd-photosensitised decomp. of C_2H_4 at 278° has a very low quantum yield, $\sim$0·01. In presence of H_2 the quantum yield is 0·5—0·7, the products being CH_4, C_2H_6, C_3H_8, C_4H_{10}, C_3H_6, and higher hydrocarbons. The suggested mechanism is $Cd\ (3P_1) + H_2 = CdH + H$; $H + C_2H_4 = C_2H_5$; $H + C_2H_5 = C_2H_6$; $H + C_2H_5 = 2CH_3$; etc. F. J. G.

Quantum yield of the hydrolysis of monochloroacetic acid. L. KÜCHLER and H. PICK (Z. physikal. Chem., 1939, **45**, **B**, 116—120).—Re-examination of the hydrolysis of aq. $CH_2Cl{\cdot}CO_2H$ by ultra-violet light gives a quantum yield of $0{\cdot}62 \pm 0{\cdot}04$ for 254 mμ. instead of the recorded val. of 1·0. W. R. A.

Mechanism of polymerisation of vinyl acetate and methyl vinyl ketone. H. W. MELVILLE, T. T. JONES, and R. F. TUCKETT (Chem. and Ind., 1940, 267—272).—The rate of polymerisation of $CH_2{:}CH{\cdot}OAc$ vapour by light of $\sim$2500 A. $\propto (p - p_0)I^{\frac{1}{2}}$, p_0 being a limiting pressure below which polymerisation does not occur. The temp. coeff. is negative, corresponding with $E \sim -4700$ g.-cal. The existence of the limiting pressure (p_0) cannot be explained. With rising temp. p_0 decreases to become ≈ 0 at $\sim$90°. The temp. coeff. of p_0 indicates some process having $E \sim 3000$ g.-cal. A radical-sensitised polymerisation, brought about by Me radicals or H atoms, is easily studied at pressures $< p_0$. Its kinetics accord with a simple radical mechanism, and are quite different from those of the direct reaction, suggesting that this does not involve free radicals. The alternative is a mechanism whereby a H atom migrates when the monomeride reacts with the active polymeride. The photopolymerisation of $CH_2{:}CH{\cdot}COMe$ is kinetically very abnormal. Both the rate and the order of the reaction increase with increasing pressure, orders as high as 5 or 6 being found. The temp. coeff. is negative, and the plot of log (rate) against $1/T$ exhibits a curvature which increases with increasing pressure. The product neither swells nor dissolves in solvents, which suggests extensive cross-linking. The general character of the kinetics is in accordance with a radical mechanism whereby in a suitablo collision a polymeride radical having two free valencies, which can propagate independently, is produced. F. J. G.

When is a substance oxidised or reduced to another substance? H. G. BOS (Chem. Weekblad, 1940, **37**, 56—57).—A list of rules for defining when a substance is oxidised is given. S. C.

Enrichment of krypton isotopes by the separation tube process. W. GROTH and P. HARTECK (Naturwiss., 1940, **28**, 47).—The method of Clusius and Dickel has been used to separate Kr into light and heavy fractions. After 5—8 days' separation the lighter fraction had at. wt. 1·51 < normal. A. J. M.

[Biological] water decomposition and oxidation as coupled reactions. K. YAMAFUGI, M. NISHIOEDA, and R. RYUSHI (Biochem. Z., 1939, **303**, 260—265; cf. A., 1939, I, 530).—In the mechanism expressed by the equations previously given, the decomp. of water is coupled with the oxidations which occur at the same time, part of the energy required for the decomp. being provided by the heat liberated in the oxidations. W. McC.

Reactions between dry inorganic salts. V. Reactions below fusion point. H. L. LINK [with L. J. WOOD] (J. Amer. Chem. Soc., 1940, **62**, 766—769; cf. A., 1938, I, 633).—42 double decomp. reactions, involving Li, Na, K, Rb, Cs, F, Cl, Br, and I, have been investigated at various temp. below the fusion point. Reaction takes place to a considerable extent at $\not>$100° below the melting range but at >200° below the melting range very little reaction occurs. The nature and stability of the products are discussed. W. R. A.

Isolation of alkali argentiperiodates, complexes of tervalent silver. L. MALAPRADE (Compt. rend., 1940, **210**, 504—505).—Oxidation of AgOH by a boiling conc. solution of KOH and KIO_4 gives a brown solution from which a cryst. *complex*, in which K : Ag : I = 6 : 1 : 2, can be isolated by evaporation in the cold; the product can be recrystallised from aq. KOH. A *salt* in which Na : K : Ag : I = 4·5 : 1·5 : 1 : 2 is pptd. on addition of NaOH to the brown solution. Determinations of available O show that these substances are derived from Ag_2O_3; they are stable in alkaline solution and in the solid state, give ozonised O_2 with dil. acids, and generally resemble the cupriperiodates (cf. A., 1937, I, 319). A. J. E. W.

Action of cuprous oxide on various compounds. E. MONTIGNIE (Bull Soc. chim., 1940, [v], **7**, 229—231).—Cu_2O reduces cold aq. $SnCl_2$ and $SnCl_4$, yielding Cu_2Cl_2 and $Sn(OH)_2$ and $Sn(OH)_4$, respectively. With $CuCl_2$ it gives Cu_2Cl_2 and $CuCl_2,3Cu(OH)_2$. This reaction is reversible and is the more complete the higher is the temp. The action of $CuSO_4$ on KI in presence of Cu_2O yields a

mixture of Cu_2I_2 and basic iodide. Cu_2O reduces cold aq. $HgCl_2$ to Hg_2Cl_2 and then to Hg and reduces Hg_3N_2 to Hg. With N_2H_4,HCl Cu_2O yields Cu_2Cl_2, Cu, and N_2, whilst with NH_2·CO·NH·NH_2,HCl NH_3 is also formed. Cu_2O liberates NH_3 from NH_4 salts; with aq. solutions of these salts deep blue solutions of complex salts are formed. HgCl·NH_2, which is not decomposed by KOH, yields NH_3 with Cu_2O. On boiling with an aq. suspension of S Cu_2O gives Cu_2S. With aq. AsI_3 Cu_2O yields As_2O_3 and Cu_2I_2. It also reacts with alkali and alkaline-earth halides, especially on boiling, yielding the Cu_2^{II} salt. J. W. S.

Copper sulphate–sodium silicate reaction. H. V. ANDERSON and F. P. HOCHGESANG (J. Physical Chem., 1940, **44**, 439—446).—Admixture of 0·1M. aq. $CuSO_4$ and Na_2SiO_3 at the b.p. yields ppts. varying in colour from light bluish-green to deep blue and from cryst. to colloidal in character as the relative mol. concns. of $CuSO_4$ and Na_2SiO_3 are changed from 2 : 1 to 1 : 2. *X*-Ray and chemical analysis indicates that the ppts. comprise $4CuO,SO_3,3H_2O$ or a mixture of this compound with $3CuO,SO_3,2H_2O$ and varying amounts of amorphous SiO_2. J. W. S.

Complex compounds of diguanide with bivalent metals. I. Copper diguanidines.—See A., 1940, II, 208.

Derivatives of diethylenetriamine [di-β-aminoethylamine].—See A., 1940, II, 207.

Reaction of solutions of gold salts with natural sulphides. O. E. ZVJAGINTZEV and A. PAULSEN (Ann. Sect. Platine, 1939, No. 16, 109—137).—The following reactions are shown to take place between aq. $AuCl_3$ or $NaAuO_2$ and certain natural sulphides: $3PbS + 2AuCl_3 \rightarrow 3PbCl_2 + 2Au + 3S$; $3PbS + 8NaAuO_2 + 4NaOH \rightarrow 8Au + 3Na_2SO_4 + 3Na_2PbO_2 + 2H_2O$; $9FeS_2 + 40AuCl_3 + 6FeCl_3 + 7H_2O \rightarrow 8FeSO_4 + 7FeCl_2 + 10H_2SO_4 + 40Au + 124HCl$; $2FeS_2 + 10NaAuO_2 + 4H_2O \rightarrow 2Fe(OH)_3 + 4Na_2SO_4 + 10Au + 2NaOH$; $6FeCuS_2 + 14AuCl_3 + 12H_2O \rightarrow 14Au + 6FeCl_2 + 6CuCl_2 + 3H_2SO_4 + 9S + 18HCl$; $14(4ZnS,FeS) + 40AuCl_3 + 20HCl + 52H_2O \rightarrow 49H_2S + 40Au + 8S + 56ZnCl_2 + 14FeCl_2 + 13H_2SO_4$; $10FeAsS + 40AuCl_3 + 5Fe_2O_3 + 65H_2O \rightarrow 8FeSO_4 + 12FeCl_2 + 40Au + 10H_3AsO_4 + 2H_2SO_4 + 96HCl$; $3(4ZnS,FeS) + 34NaAuO_2 + 10H_2O \rightarrow 34Au + 12Zn(OH)_2 + 3Fe(OH)_2 + 12Na_2SO_4 + 3S + 10NaOH$. $NaAuO_2$ is very unstable in aq. alkaline solution, and probably could not exist under natural conditions. Deposition of Au in the cementation zone of natural sulphide deposits from $AuCl_3$ formed in the oxidation zone is quite possible. R. T.

Magnesium phosphonitrilamide; existence of compounds analogous to cyanamides in the phosphorus series. H. MOUREU and G. WETROFF (Compt. rend., 1940, **210**, 436—438).—The reaction between P_3N_5 and compact Mg during progressive heating from 500° to 810° is $4P_3N_5 + 21Mg = 6Mg_2PN_3 + N_2 + 3Mg_3P_2$. The *compound* Mg_2PN_3 (Mg phosphonitrilamide) is a yellow powder, stable in air and in a vac. at 900°; its hydrolysis affords an unidentified cryst. solid, but no gaseous products. Mg_2PN_3 and Cl_2 at 700° give PN chlorides, chiefly $(PNCl_2)_3$, $MgCl_2$, and N_2. The corresponding *Ca compound* has been obtained in admixture with Ca_3P_2 by a similar but more violent reaction at ~200°. A. J. E. W.

Preparation of fluorescent calcite. G. R. FONDA (J. Physical Chem., 1940, **44**, 435—439).—Natural fluorescent calcite loses its fluorescence after ignition, but fluorescent material can be produced by heating CaO or $CaCO_3$ containing <0·1% (preferably 0·005%) of MnO in CO_2 at 1000° for 30—60 min. This product contains 1·5—10 mol.-% of $CaCO_3$, and is distinct from CaO and $CaCO_3$ phosphors since the fluorescence disappears when all the $CaCO_3$ is decomposed or when the $CaCO_3$ content is unduly increased. Fluorescent calcite can be prepared by pptn. from a mixture of dil. aq. $CaCl_2$ (30 mols.) and $MnCl_2$ (1 mol.) with excess of aq. $(NH_4)_2CO_3$ at ~70°. The product should be boiled for 10 min. or kept for several weeks before filtering, when it has 30% of the fluorescence of the natural product. The addition of Mn is shown to cause a contraction of the lattice parameters. No fluorescence was observed in calcite pptd. in presence of Pb, Cu, Bi, or Sm. Attempts to prepare fluorescent aragonite by pptn. at 100° in presence of Mn, Pb, Cu, or Sm have been unsuccessful. In the presence of 16·6 mol.-% of $Mn^{··}$, calcite is pptd. even at 100°. J. W. S.

Preparation of phosphors. E. STRECK (Z. physikal. Chem., 1940, **186**, 19—26).—Ignition of the materials in a sealed quartz tube avoids losses by volatilisation, and the high pressure and even heating are also advantageous. The optical behaviour of ZnS–Cu phosphors obtained in this way is quite independent of the duration of ignition, and the max. luminescence occurs at [Cu] < with phosphors prepared in the usual way. F. J. G.

Preparation and properties of diborane diphosphine. E. L. GAMBLE and P. GILMONT (J. Amer. Chem. Soc., 1940, **62**, 717—721).—2 vols. of PH_3 react with 1 vol. of B_2H_6 slowly in (*a*) the gas phase at > −30°, fairly rapidly in (*b*) the liquid phase at > −110°, yielding *diborane diphosphine* (I), $B_2H_6,2PH_3$ or BH_3,PH_3, white cryst. needles (*a*), microcryst. mass (*b*). (I) dissociates at > −30° to give B_2H_6 and PH_3, the dissociation pressure at 0° being ~200 mm. It is spontaneously inflammable, is decomposed by H_2O to H_2, PH_3, and H_3BO_3, and when heated rapidly to 200° affords H_2 and a non-volatile product (unidentified). It dissolves very slowly in liquid NH_3 at −78° with no apparent reaction, but at higher temp. PH_3 is evolved, but never to > ~55% of the total PH_3. After keeping, and removal of the liquid NH_3, a white pasty solid, *diborane diphosphine ammine*, B_2H_6,PH_3,NH_3 (II), remains. Depending on the time and temp. of the reaction, gaseous NH_3 reacts with (I) and displaces part of the PH_3. (II) is more stable than (I) and is probably the NH_4 salt, $NH_4(BH_3PH_2BH_3)$. (I) with HCl, under certain conditions, yields a chlorinated clear, viscous, non-volatile liquid of empirical composition $B_2H_4Cl_2,2PH_3$ which reacts with more HCl to give white, cryst. $B_2H_2Cl_4,2PH_3$ [m.p. 68° (decomp.)]; this when heated at 100° for 1 hr. yields BCl_3,PH_3. HBr gives compounds of (I) similar

to those of HCl. Four structures of (I) are considered, $(PH_4)_2B_2H_4$, BH_3,PH_3, $PH_4(BH_3PH_2BH_3)$, and $B_2H_6,2PH_3$, but none is completely satisfactory. No trace of $B_3P_3H_6$, the cyclic analogue of $B_3N_3H_6$, could be obtained. W. R. A.

Translucent films of aluminium oxide. R. E. VOLLRATH (J. Physical Chem., 1940, **44**, 401—404).—Anodic oxidation of Al foil 0·002 cm. thick in 3% aq. $H_2C_2O_4$ yields translucent films of Al_2O_3 containing small specks of Al. The formation of these specks can be avoided by allowing the level of the $H_2C_2O_4$ to rise slowly up the surface of the foil, so that the oxidation proceeds systematically upwards. J. W. S.

Hydrogen cyanide. XI. Constitution of the double compound of hydrogen cyanide and aluminium chloride. L. E. HINKEL and T. I. WATKINS (J.C.S., 1940, 407—409).—Br reacts with HCN in C_6H_6 affording HBr, CNBr, PhBr, PhCN, PhCHO, $CHPh_2\cdot NH_2$, and cyaphenin. With $AlCl_3,2HCN$ (I) suspended in C_6H_6, Br affords no CNBr. The product is $CHPh_3$ (II), or in presence of additional $AlCl_3$, $COPh_2$ (III). The formation of (III), but not of (II), is easily accounted for in terms of the structure $AlCl_3,NH\!:\!CH\cdot NC$ for (I). F. J. G.

Cyanates of silicon, phosphorus, and boron. Instability of certain ternary boron compounds. G. S. FORBES and H. H. ANDERSON (J. Amer. Chem. Soc., 1940, **62**, 761—763).—By treating AgNCO with $SiCl_4$ in boiling C_6H_6 a product was obtained separable into high- and low-boiling fractions which gave identical analyses. Structures have been assigned to these fractions (i) by analogy with EtNCO and EtOCN, (ii) by investigating the products of their hydrolysis: *Si isocyanate*, $Si(NCO)_4$, b.p. 185·6± 0·3°, m.p. 26·0±0·5°, $\log_{10} p$ (mm.) = 9·0198 − 2816/T, ρ 1·409, 1·413±0·005 g. per c.c., n 1·4610± 0·0003, and *Si cyanate*, $Si(OCN)_4$, b.p. 247·2±0·5°, m.p. 34·5±0·5°, $\log_{10} p$ (mm.) = 9·8211—3611/T, ρ = 1·414±0·005 g. per c.c., and n 1·4646±0·0003. PCl_3 treated similarly with AgCNO gave *P isocyanate*, $P(NCO)_3$, m.p. −2·0°, b.p. 169·3°, $\log_{10} p$ (mm.) = 8·7455 − 2595/T, ρ 1·439 g. per c.c., n 1·5352. This after cooling to −20° and keeping yielded a white polymeride insol. in org. solvents, but reconverted into sol. liquid when heated. *B cyanate*, $B(OCN)_3$, prepared from BBr_3 and AgNCO, decomposed without melting and could not be sublimed. Attempts to prepare B chlorobromides, fluorobromides, oxychloride, and oxybromide have proved unsuccessful. W. R. A.

Enrichment of ^{15}N by the Clusius-Dickel separation tube process. R. FLEISCHMANN (Physikal. Z., 1940, **41**, 14—18).—A fraction containing 9·2% of $^{14}N^{15}N$, and from this, one containing 18% of $^{14}N^{15}N$, have been obtained from ordinary N_2. A. J. M.

Nitrogen bromide. M. SCHMEISSER (Naturwiss., 1940, **28**, 63).—The *compound* $NBr_3,6NH_3$ has been obtained by the action of Br on NH_3 under 1—2 mm. pressure at −95°. It is a purple-red solid, decomp. violently above −70° according to the equation $NBr_3,6NH_3 = N_2 + 3NH_4Br + 2NH_3$. A. J. M.

Niobium oxides. G. BRAUER (Naturwiss., 1940, **28**, 30).—Chemical and X-ray investigations of the Nb–O_2 system indicate the existence of Nb_2O_5, NbO_2, and NbO. Nb_2O_5 occurs in at least two different forms, one of which is obtained when niobic acid, pptd. from aq. solution, is dehydrated at 600—800°. When this form is heated to temp. >800° a form giving a different X-ray pattern is produced. The m.p. of Nb_2O_5 in O_2 is 1460°. NbO_2 was obtained by reduction of Nb_2O_5 by H_2 or Nb. H_2, even at 1600°, does not reduce Nb_2O_5 beyond the NbO_2 stage. Contrary statements in the literature are due to the use of impure H_2. By heating mixtures of Nb_2O_5 and NbO_2 at 1400°, phases of the type NbO_x (x = 2·0—2·5) were produced. The structure of NbO_2 approximates to the rutile type, but is not identical with it. When NbO_2 is heated with Nb to 1750° in an atm. of A, NbO is obtained. It is a metallic-grey powder, cubic, a = 4·20 A. A. J. M.

Reduction of niobium pentoxide by hydrogen. G. GRUBE, O. KUBASCHEWSKI, and K. ZWIAUER (Z. Elektrochem., 1939, **45**, 885—888).—The reduction of Nb_2O_5 by a mixture of H_2 and H_2O vapour (partial pressure p_{H_2O}), at atm. pressure, is studied. NbO_2 is formed from Nb_2O_5 in A at 1150—1300°; NbO_2 and Nb_2O_5 are in equilibrium with H_2–H_2O at 860 ± 10° or 1070 ± 12°, with p_{H_2O} = 11·3 or 31·7 mm., respectively. With p_{H_2O} = 1·44 mm. at 1300—1350° the reduction product is nearly pure Nb_2O; a similar product is obtained more rapidly with pure H_2. "Nb_2O_3" and NbO are obtained by appropriate interruption of the reduction process. The individuality of Nb_2O, NbO, NbO_2, and Nb_2O_5 is proved by Debye-Scherrer data, but "Nb_2O_3" is a mixture of NbO and NbO_2. A. J. E. W.

Preparation of alkali bismuth saccharates. See A., 1940, II, 204.

Chromium chromate. P. C. R. CHAUDHURY (J. Indian Chem. Soc., 1939, **16**, 652—656).—$AgCrO_4$ with conc. aq. $CrCl_3$ gives $Cr[Cr(CrO_3)_3(H_2O)_3]$, which is shown by cryoscopic measurement to dissociate into two ions, whereas $Cr_2(CrO_4)_3$ would give five ions. Also the p_H of the solution is ≫ that of H_2CrO_4, and the adsorption spectrum shows by comparison with $CrCl_3$, $K_2Cr_2O_7$, and H_2CrO_4 the presence of an ion other than Cr^{III}, CrO_4'', or Cr_2O_7''. The magnetic susceptibility is 1942·72 × 10^6 and the magnetic moment 10·79 per g.-atom of Cr and is independent of the state of ionisation. F. R. G.

Reaction of uranium dioxide with compounds of the noble metals. R. LYDÉN (Finska Kem. Medd., 1939, **48**, 115—123).—UO_2 displaces Ag, Au, Pt, and Pd from solutions of their salts, giving, *e.g.*, $3UO_2 + 2KAuCl_4 \rightarrow 3UO_2Cl_2 + 2KCl + 2Au$. With Pt^{IV} salts the reaction takes place in two stages: $UO_2 + Pt^{\cdot\cdot\cdot\cdot} \rightarrow [UO_2]^{\cdot\cdot} + Pt^{\cdot\cdot}$, followed by: $UO_2 + Pt^{\cdot\cdot} \rightarrow [UO_2]^{\cdot\cdot} + Pt$. M. H. M. A.

Reaction of U_3O_8 with alkali hydrogen carbonate solutions. R. LYDÉN (Finska Kem. Medd., 1939, **48**, 124—128).—*U_2O_5* is formed from U_3O_8 by the reaction: $U_3O_8 + 4KHCO_3$,aq. $\rightarrow K_4[UO_2(CO_3)_3]$,aq. $+ U_2O_5 + CO_2 + H_2O$, after >24 hr. on the H_2O-

bath; it is not decomposed when heated in a sealed tube with excess of aq. $KHCO_3$. M. H. M. A.

Affinity. XCIII. Uranium sulphides. E. F. Strotzer, O. Schneider, and W. Biltz (Z. anorg. Chem., 1940, **243**, 307—320).—The system U–S has been studied preparatively, and by means of *X*-rays and (in part) of tensimeter curves. In addition to US_2 and U_2S_3, a *trisulphide* US_3, and a *subsulphide*, apparently U_4S_3, exist. US_3 is obtained by heating US_2 with S at 600—800°, the excess of S being removed by means of CS_2 or at 300° in a vac. It has ρ_4^{25} 5·81, mol. vol. 57·5, and (from the tensimeter curves) heat of formation from $US_2 + \frac{1}{2}S_2$ 40 kg.-cal. per g.-mol. at ~650°. US_2 has ρ_4^{25} 7·96, mol. vol. 38·0. Data on ρ and mol. vol. for preps. having $S:U < 1·5:1$ are given. The mol. vol. in this region is not a linear function of composition. F. J. G.

Reduction of solutions of inorganic oxidising compounds by active carbon. A. Ramat (Bull. Soc. chim., 1940, [v], 7, 227—229).—On agitation with activated C aq. $KMnO_4$ changes in colour to green. When kept it returns to reddish-brown, but the green colour is restored by further agitation. $Fe_2(SO_4)_3$ and $K_3Fe(CN)_6$ show similar reduction, and it is suggested that adsorption by activated C is frequently preceded by reduction. J. W. S.

Precipitation of manganous carbonate.—See B., 1940, 357.

Preparation of high-purity iron on a large laboratory scale. F. Adcock (J.S.C.I., 1940, **59**, 28—31).—The prep. of high-purity Fe at the rate of 500 g. per working day is described. Commercial electrolytic Fe was converted into $FeCl_2$, which was then treated with superheated steam to obtain Fe oxide. The finished Fe was produced by H_2 reduction of the oxide and subsequent vac. fusion of the metal. Difficulties in the provision of suitable refractory crucibles were overcome by the use of sintered Al_2O_3.

Preparation of iron, copper, and nickel in powder form by reduction of oxides with hydrogen. I. P. Kisljakov (J. Appl. Chem. Russ., 1939, **12**, 1668—1677).—Directions for reduction of Fe_2O_3, CuO, and Ni_2O_3 to the metals are given. R. T.

Ferritartrates.—See A., 1940, II, 153.

Stereochemistry of complex inorganic compounds. VII. Mechanism of the Walden inversion in some reactions leading to the formation of the carbonatodiethylenediaminecobaltic ion. J. C. Bailar, jun., and D. F. Peppard (J. Amer. Chem. Soc., 1940, **62**, 820—823).—Evidence is advanced confirming the suggested explanation of the conversion of *l*-[Co en_2Cl_2]Cl (I) into *d*-[Co $en_2CO_3]_2CO_3$ as arising from intermediate formation of *l*-[Co en(H_2O)Cl]Cl_2 (II) (A., 1940, I, 80) whilst conversion of (I) into *l*-[Co $en_2CO_3]_2CO_3$ takes place directly. The conversions of *l*-[Co en_2ClBr]Cl and of *l*-[Co en_2Br_2]Br agree with those of (I) but none of the three with oxalates gives a product of inverted configuration. (II) is converted into (I) by suspending it in $SOCl_2$. W. R. A.

Complex salts of cobalt[III] with dimethylglyoxime [and aromatic amines].—See A., 1940, II, 162.

Cobaltic bisdiguanidines and trisphenyldiguanidines.—See A., 1940, II, 208.

Electron diffraction study of surface reaction between nickel oxide and corundum. H. R. Thirsk and E. J. Whitmore (Trans. Faraday Soc., 1940, **36**, 565—574).—Ni vapour condensed on the surface of corundum consists of unoriented crystals, as does also the NiO formed by heating the condensed Ni film in air. If, however, NiO vapour is condensed on the corundum the crystals assume special orientations depending on the crystallographic direction of the surface. NiO reacts slowly with corundum at 900° to form Ni spinel, which takes up orientations similar to those of the NiO. The most perfect orientation occurs on the prism face $\{11\bar{2}, 0\}$. Some of the observations suggest that diffusion of metal ions can occur only in the spinel lattice. F. L. U.

Hydrate isomerism and hydrolysis of ruthenium trichloride. G. Grube and H. Nann (Z. Elektrochem., 1939, **45**, 871—874).—$RuCl_3,H_2O$, prepared by evaporation of aq. $RuCl_3$ in a vac. over H_2SO_4, dissolves in ice-H_2O to give a brown or greenish-brown solution which contains no ionic Cl. When kept the solution becomes green, and after 80 min. at 2° $\frac{1}{3}$ of the total Cl is pptd. on addition of $AgNO_3$, probably owing to the change $[RuCl_3H_2O] + H_2O \rightarrow [RuCl_2(H_2O)_2]Cl$. When heated the solution again becomes brown, and conductivity measurements indicate hydrolysis, possibly $[RuCl_2(H_2O)_2]Cl + H_2O \rightarrow [RuOHCl(H_2O)_2]Cl + HCl$, etc.; after 47 hr. at 50°, 2·91 atoms of Cl per Ru are titratable by $AgNO_3$, and are largely present as HCl, although no insol. products are formed. A. J. E. W.

Preparation of ternary rhodium salts. N. K. Pschenitzin and S. K. Schabarin (Ann. Sect. Platine, 1939, No. 16, 45—52).—When $[Pt(NH_3)_4]Cl_2$ (I) is added to a solution of $(NH_4)_3RhCl_6$ (II) in aq. NH_4NO_3, a ppt. of $NH_4[RhCl_6][Pt(NH_3)_4]$ is obtained. In absence of NH_4NO_3 (II) is converted into $(NH_4)_2[RhCl_5,H_2O]$, which combines with (I) to yield $[RhCl_5,H_2O][Pt(NH_3)_4]H_2O$. With $RbNO_3$ or $CsNO_3$ conc. solutions of (I) give $[RhCl_5,H_2O]M_2$ (M = Rb, Cs). R. T.

Rhodium sulphito-ammines. V. V. Lebedinski and N. N. Miasojedov (Ann. Sect. Platine, 1939, No. 16, 65—76).—Aq. $(NH_4)_3RhCl_6$ and aq. $NaHSO_3$ (1 hr. at 100°) yield a ppt., which when treated with aq. NH_3 (1—1·5 hr. at 100°) gives $Na_2[Rh(NH_3)_3,(SO_3)_2,SO_3Na],6H_2O$. The *salts* $Zn[Rh(NH_3)_3,(SO_3)_2,SO_3Na],6H_2O$, $[C(NH)(NH_2)_2H]_2[Rh(NH_3)_3,(SO_3)_2,SO_3Na]$, and $Ag_3Rh(NH_3)_3(SO_3)_3,1·5H_2O$ are prepared therefrom. R. T.

Compounds of iridium [salts] with acetonitrile. V. V. Lebedinski and P. V. Simanovski (Ann. Sect. Platine, 1939, No. 16, 53—56).—MeCN and a boiling solution of $(NH_4)_3IrCl_6$ in aq. NH_4Cl yield $(NH_4)_2[IrCl_5,MeCN],H_2O$ (corresponding K_2 salt, $+2H_2O$; *diguanidino*-salt; $[Pt(NH_3)_4]$ salt). R. T.

Oxalates of ammonium-pyridine platinum compounds. V. I. GOREMIKIN and K. A. GLADISCHEVSKAJA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 242—244).—Prep. of the following *salts* is described $[Pt(C_5H_5N)_4]C_2O_4,H_2O$; $[Pt(NH_3)(C_5H_5N)_3]C_2O_4$; *cis*- and *trans*-$[Pt(NH_3)_2(C_5H_5N)_2]C_2O_4,2H_2O$; $[Pt(NH_3)_3(C_5H_5N)]C_2O_4$; *cis*-$[Pt(C_5H_5N)_2(C_2O_4)]$ and $[Pt(NH_3)(C_5H_5N)(HC_2O_4)_2],4H_2O$. W. R. A.

Hydroxylamine-thiocarbamide platinum compounds. V. I. GOREMIKIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 238—241).—Prep., properties, and μ^{25} of the *compounds* $[Pt(NH_2OH)_2\{CS(NH_2)_2\}_2]Cl_2$, $[Pt\ NH_2OH\ NH_3\{CS(NH_2)_2\}_2]Cl_2$, $[Pt\ NH_2OH\ C_5H_5N\{CS(NH_2)_2\}_2]Cl_2$, and $[Pt\ NH_3\ C_5H_5N\{CS(NH_2)_2\}_2]Cl_2$ are given. W. R. A.

Tetra-amminodisulphitoplatinum. S. A. BORISOV-POTOTZKI (Ann. Sect. Platine, 1939, No. 16, 41—44).—SO_2 passed into a solution of $Pt(NH_3)_4Cl_2$ in aq. KNO_2 yields $[Pt(NH_3)_4(SO_3)_2],2H_2O$, converted by heating into $Pt(NH_3)_4SO_4$. R. T.

(A) **Quadrivalent platinum triammines.** (B) **Quadrivalent platinum tetrammine.** I. I. TSCHERNIAEV (Ann. Sect. Platine, 1939, No. 16, 5—11, 13—19).—(A) $Pt(NH_3)_2Cl_2$ and aq. NH_3 at 95—98° yield $[Pt(NH_3)_3Cl_3]Cl$ (I), converted by aq. KOH into $[Pt,(NH_3)_2,NH_2,Cl]$, which with HNO_3 or H_2SO_4 gives $[Pt(NH_3)_3Cl_3]NO_3,H_2O$ or $[Pt(NH_3)_3Cl_3]_2SO_4,3H_2O$, respectively. (I) and $AgNO_2$ afford $[Pt,(NH_2)_3,Cl,NO_2,Cl]Cl$, which with KOH yields $[Pt,(NH_3)_2,NH_2,Cl,NO_2,Cl]$. $[Pt(NH_3)_3Cl]Cl$ and aq. $AgNO_3$ give $[Pt,(NH_3)_3,H_2O,(NO_3)_2]$, which with Br in aq. KBr affords $[Pt(NH_3)_3Br_3]Br,H_2O$.

(B) 20% aq. NH_3 when added to (I) affords $[Pt,(NH_3)_3,Cl,NH_3,Cl]Cl_2$ (II), which with aq. KOH gives $[Pt,(NH_3Cl)_2,NH_2,NH_3]OH,H_2O$. (II) is reduced by N_2H_4 to $[Pt(NH_3)_3Cl]Cl$. R. T.

Ethylene compounds of platinum nitrochlorides. (MISS) A. GELMAN and I. B. LITVAK (Ann. Sect. Platine, 1939, No. 16, 29—33).—Aq. $NaNO_2$ added to conc. aq. $K[PtCl_3,C_2H_4]$ gives $K[Pt,C_2H_4,Cl,(NO_3)_2]$, which with $Pt(NH_3)_4Cl_2$ affords $[Pt(NH_3)_4][Pt,C_2H_4,Cl,(NO_3)_2]_2$. Attempts to prepare analogous Co and Ni complexes were unsuccessful. R. T.

Compounds of platinum [salts] with acetonitrile. V. V. LEBEDINSKI and V. A. GOLOVNIA (Ann. Sect. Platine, 1939, No. 16, 57—64).—Aq. $[Pt(NH_3)_2Cl_2]$ is shaken with MeCN (1—1·5 hr. at 100°), the solution is filtered, and Na picrate is added to the filtrate, giving a ppt. of $[Pt,Cl,(NH_3)_2,MeCN]\cdot O\cdot C_6H_2(NO_2)_3$; the corresponding *platinochloride* is obtained analogously. Very sol. $[Pt(NH_3)_4,MeCN]Cl$ (I) is obtained by boiling the filtrate with aq. NH_3, or similarly from $[PtCl_2,NH_3,MeCN]$ or $[PtCl_3,MeCN]$; the *platinochloride* and *picrate* of (I) are described. One of the NH_3 groups of (I) is probably combined with MeCN. R. T.

Compounds of platinum [salts] with ethylenic hydrocarbons. A. GELMAN (Ann. Sect. Platine, 1939, No. 16, 21—28).—Ag. K_2PtCl_4 and $CHR\colon CH_2$ give complexes of the type $K[PtCl_3,CHR\cdot CH_2]$, converted by aq. NH_3 or C_5H_5N into $[PtCl_2,NH_3,CH_2\colon CHR]$ or $[PtCl_2,C_5H_5N,CHR\colon CH_2]$ (R = Me, Et, Ph); $(PtCl_2,CHPh\colon CH_2)_2$ is a by-product in the case of $CHPh\colon CH_2$. $NH_4[PtBr_3,NH_3]$ and C_2H_4 affords cis- and trans-$[PtBr_2,NH_3,C_2H_4]$; cis- and trans-$[PtBr,C_5H_5N,C_2H_4]$ are prepared analogously. R. T.

Fluorescence analysis. I. Fluoremetry of fluorescein and eosin. II. Fluorescence indicators. H. GOTÔ (Sci. Rep. Tôhoku, 1940, **28**, 458—464, 465—479).—I. Apparatus using filtered ultra-violet light is described. Changes in intensity of fluorescence between p_H 2·71 and 12·84 are recorded for fluorescein (I) and eosin (II). Fluorescence of (I) between p_H 5·6 and 13·0 is strong enough to be used, but accurate determinations should be carried out at p_H >9·6. The intensity of fluorescence of (II) is unchanged over a wide range of p_H, and (II) can be determined at p_H >4·5; most of the fluorescence disappears between p_H 3 and 4.

II. The intensities of fluorescence of various indicators over different ranges of p_H are recorded. The p_H ranges at which fluorescence disappears or changes in colour are: salicylic acid 2·5—4·0, erythrosin 4·0—4·5, phloxin 2·5—4·0, umbelliferone 6·5—8·0, quinine 3·0—5·0, acridine 5·2—6·6, β-$C_{10}H_7\cdot OH$ 8·5—9·5, β-$OH\cdot C_{10}H_6\cdot SO_3H$ 8·0—9·0, coumarin 9·5—10·5, naphthionic acid 2·5—3·5 and 11·6. The characteristics and suitability of these indicators are discussed. L. S. T.

Rôle of the temperature factor in determining p_H by means of the glass electrode. V. A. PTSCHELIN (J. Appl. Chem. Russ., 1939, **12**, 1548—1554).—The magnitude of the val. $\Delta E/\Delta p_H$ obtained when e.m.f. is measured by the ballistic method depends chiefly on the degree of saturation of the condenser, *i.e.*, on the duration of charging. With fully charged condensers the vals. of $\Delta E/\Delta p_H$ found for a no. of buffer solutions were identical, using a glass or a H_2 electrode at 30—50°. At 10° the time required for full saturation of the condenser becomes very great. The increase in the temp. factor at low temp. is ascribed chiefly to increase in resistance of the glass electrode, which approaches that of the potentiometer circuit; in that case temp. differences between the electrode and the potentiometer may cause considerable errors. Where errors of $\pm 0\cdot 1$ p_H are admissible temp. variations of 1—2° may be neglected; in other cases calibration curves should be applied. Morton's conclusions as to the applicability of the glass electrode are not upheld (A., 1934, 492). R. T.

Determination of p_H value of clay by the glass electrode.—See B., 1940, 358.

Electrochemical method of determining iodine. M. TOVBIN and M. FELDMAN (J. Phys. Chem. Russ., 1939, **13**, 818—825).—The method described for the determination of small amounts of free I in solution depends on its depolarising action. The decomp. of KI in aq. solution in ultra-violet light is autocatalysed by I. The rate of reaction of I with starch has been measured. R. C.

Direct determination of oxygen in zinc oxide.—See B., 940, 356.

Oxidation of thiophen-sulphur by calcium hypochlorite solutions. E. G. R. ARDAGH, W. H. BOWMAN, and A. S. WEATHERBURN (J.S.C.I., 1940, **59**, 27—28).—Factors influencing the proportion of thiophen-S converted into SO_4'' as a result of oxidative action of $Ca(OCl)_2$ solutions (I) are discussed. The p_H vals. most effective for the oxidation of thiophen by this method are ~7—8; such vals. for (I) will result from the use of an initial p_H 8 or, for long periods of treatment, p_H 9. The use of other acidifying agents for the adjustment of the initial p_H gave essentially the same results as AcOH.

Volumetric determination of sulphuric acid in potassium permanganate solutions.—See B., 1940, 356.

Detection and determination of ortho-, pyro-, and meta-phosphoric acid in the presence of one another. B. WURZSCHMITT and W. SCHUHKNECHT (Angew. Chem., 1940, **52**, 711—715).—PO_4''' (I) gives a yellow ppt. in 30 sec. with twice its vol. of Lorenz's molybdate solution, whereas PO_3' (II) reacts only after 90 sec., and P_4O_7'''' (III) after a much longer time. To detect (III) the solution is saturated with NH_4I, adjusted just to blue with bromophenol-blue, and boiled with half its vol. of 10% aq. ZnI_2; if (III) is present a white flocculent ppt. is formed and the solution becomes yellow. (II) gives a white flocculent ppt. when the solution, just acid with AcOH, is boiled with 10% aq. $BaCl_2$; in this test much (III) gives a slight cryst. ppt. whilst (I) gives no ppt. $(PO_3)_3'''$ (IV) is detected by removing (I), (III), and $(PO_3)_6^{VI}$ with $BaCl_2$ in boiling neutral (phenolphthalein) solution and testing the filtrate with molybdate after hydrolysis of (IV). For quant. analysis total P_2O_5 is determined by pptn. with molybdate after boiling with HNO_3 and drying the ppt. in vac. for weighing; (III) is determined by treating 100 c.c. of the solution, neutralised to a Me_2-yellow–methylene-blue indicator, with 25 c.c. of a solution containing 10% of ZnI_2 and 20% of NH_4I, and titrating with N-NaOH until a pure green colour is obtained. (I) is determined by treating the solution (100 c.c.) with 15 g. of NaCl, 50 c.c. of 10% aq. Na_2MoO_4, and 30 c.c. of EtOAc, cooling in ice, and shaking with 50 c.c. of ice-cold N-HCl. The EtOAc layer is separated and evaporated to dryness, the residue oxidised with HNO_3 and dissolved in aq. NH_3, and the solution pptd. with the Lorenz molybdate solution. (II) is determined by difference: total P_2O_5 less that present as (I) and (III). A. R. P.

Cerimetric determination of small amounts of arsenic after reduction with hypophosphite reagent. I. M. KOLTHOFF and E. AMDUR (Ind. Eng. Chem. [Anal.], 1940, **12**, 177—179).—As^{III} and As^{V} are reduced to As by heating at 80—90° with $Ca(H_2PO_2)_2$ in ~6N-HCl. Reduction is also quant. but slower in 3N-HCl (cf. B., 1929, 1046). The As is dissolved in an excess of 0·005N-$Ce(SO_4)_2$, and the excess back-titrated with 0·005N-As_2O_3 in presence of OsO_4 as catalyst and with *o*-phenanthroline–$Fe^{\cdot\cdot}$ complex as indicator. 1 mg. of As can be determined with an accuracy of 0·5% and 0·1 mg. with an accuracy of 1—2%. Sn and Sb do not interfere. 0·05N-$Ce(SO_4)_2$ in N-H_2SO_4 is stable for >8 months, and 0·005N-$Ce(SO_4)_2$ is stable after keeping for one week to oxidise traces of reducing substances present. Test data, details of procedure, and funnels for filtering small amounts of As are described. L. S. T.

Colorimetric determination of arsenic in alloys.—See B., 1940, 364.

Determination of small amounts of arsenic in copper.—See B., 1940, 365.

Colorimetric determination of carbon monoxide. S. M. TSCHUMANOV and M. B. AXELROD (J. Appl. Chem. Russ., 1939, **12**, 1568—1570).—Fe^{III} on SiO_2 gel is reduced by CO, and the Fe^{II} produced is indicated by a blue colour given with $K_3Fe(CN)_6$; the reaction is not quant. R. T.

Simplification of Power's method for the determination of carbon dioxide in natural waters and comparison with the titration method. C. A. PETERS, S. WILLIAMS, and P. C. MITCHELL (Ecology, 1940, **21**, 107—109).—Temp. corrections and a simplified calculation are given. L. G. G. W.

Rapid determination of hydrogen cyanide in gases.—See B., 1940, 336.

Determination of caustic alkali in soaps.—See B., 1940, 373.

Volumetric determination of small quantities of barium and sulphate with barium rhodizonate as indicator. Determination of sulphur in iron pyrites. C. C. MILLER (J.C.S., 1940, 401—406).—A standard procedure is described, whereby a suspension of the scarlet modification of Ba rhodizonate in EtOH may be used as indicator in the titration of Ba with SO_4'', and of SO_4'' indirectly. Results are accurate to 1% for 4—20 mg. of SO_4'', in presence of many cations including $Al^{\cdot\cdot\cdot}$ and $Fe^{\cdot\cdot}$, but PO_4''' causes errors ~ +2%. F. J. G.

Spectrographic determination of small concentrations of beryllium in magnesium alloys.—See B., 1940, 367.

Determination of free magnesia in magnesian lime.—See B., 1940, 356.

Empirical mercurimetric method for [determination of] zinc. A. C. TITUS and J. S. OLSEN (Ind. Eng. Chem. [Anal.], 1940, **12**, 133—135).—The routine method described consists of pptg. $Zn^{\cdot\cdot}$ as $ZnHg(CNS)_4$ (I), dissolving the washed ppt. in 0·11N-KI, and titrating the apparent excess of KI with 0·1N-$Hg(NO_3)_2$ (Fe^{III} alum). The relation between the apparent consumption of I′ and $Zn^{\cdot\cdot}$ is represented by a linear equation. With 0·16 g. of Zn the error is ~ 0·6%. Many impurities possibly present in the original sample are removed in the filtrate from (I), and do not interfere. L. S. T.

Separation of cadmium from zinc using granular aluminium. F. E. TOWNSEND and G. N. CADE, jun. (Ind. Eng. Chem. [Anal.], 1940, **12**, 163—164).—Cd and Zn are first separated from other elements of the H_2S and $(NH_4)_2S$ groups by standard methods, and Pb is removed by evaporation with H_2SO_4. The filtrate from the $PbSO_4$ is eventually boiled twice with granular Al to ppt. Cd, and the

Al removed by dissolution in NaOH. The Cd is then determined by titration with standard $K_4Fe(CN)_6$, using UO_2 acetate as external indicator, or by electro-deposition from CN′ solution. No Cd is left in the filtrate after two pptns. with Al, and no Zn occurs in the washed Al + Cd ppt. From samples containing much Zn or Fe, the Cd and some of the Zn should first be pptd. with H_2S. Details of procedure and test analyses for Cd in different commercial products are recorded. The use of granular Al reduces the no. of H_2S separations in determining Cd, and saves time. L. S. T.

Analysis of cadmium-plating solutions.—See B., 1940, 368.

Micro-detection and micro-determination of silver and mercury. G. BOUILLOUX (Bull. Soc. chim., 1940, [v], **7**, 184—187).—Methylene-blue (I) mercuri-iodide reacts with $Ag^{\cdot}$ in solutions acidified with AcOH with liberation of the free dye. This reaction can be utilised for the detection and colorimetric determination of 1—35 µg. of $Ag^{\cdot}$ in 1 c.c. of solution. Unless the solution is deeply coloured by presence of large amounts of Cu, Ni, Co, Cr, or U, common metals (except Fe^{III}) do not interfere with the test, but CrO_4'', $AuCl_4'$, $PtCl_6''$, and $Fe(CN)_6''''$, which ppt. (I), and materials which liberate I from I′ must be absent. (I) mercuri-iodide can also be used as an external indicator in the determination of halogens with $AgNO_3$ and of I′ with $Hg(NO_3)_2$. The reagent is obtained by pptg. 1% aq. (I) with excess of aq. K_2HgI_4, prepared by saturating conc. aq. KI with HgI_2. The ppt. is washed with 0·01% aq. (I) until the filtrate is slightly coloured, and is then washed with aq. AcOH. It is stored as a suspension in very dil. AcOH. J. W. S.

Polarographic method of determining lead and tin in potassium fluoroxyniobate and niobium. A. S. SCHACHOV (J. Appl. Chem. Russ., 1939, **12**, 1555—1559).—Pb may be determined in alkaline or acid citrate solution, but Sn, and Pb in presence of Sn, only in alkaline solution. Trustworthy results are obtained for K_2NbOF_5 and Nb containing Pb 0·2—0·5 and Sn 0·9—1·2%. R. T.

Use of adsorption processes for the detection of "traces." K. L. SUTHERLAND (Nature, 1940, **145**, 553).—Air displaces H_2O from a polished surface of pyrite when 25 mg. per l. of $OEt\cdot CS_2K$ (I) are added to the H_2O; one part of CN′ in 2×10^7 of H_2O prevents this. The surface of sphalerite becomes air-avid when 0·006 mg. per l. of $Pb(NO_3)_2$ is added to H_2O containing (I). Similarly, 8 parts of $Cu^{\cdot\cdot}$ in 10^8 of H_2O can be detected in presence of $NEt_2\cdot CS_2Na$. L. S. T.

Determination of traces of lead and thallium in pharmaceutical chemicals.—See B., 1940, 402.

Iodofluoride method for the determination of copper. Effects of antimony, aluminium, and calcium. W. R. CROWELL and A. T. SPIHER (Ind. Eng. Chem. [Anal.], 1940, **12**, 147; cf. A., 1938, I, 271).—Sb in amounts >20 mg. must be absent; $Cu^{\cdot\cdot}$ is probably adsorbed by antimonic acid during the treatment with mineral acids. 0·3 g. of Al as sulphate, 0·2 g. each of Al and Fe, and 0·2 g. each of Al, Fe, and As can still be present and the average error in the results be <0·1%. If $CaSO_4$ is filtered off and washed before the addition of NH_3 and NH_4F,HF, 0·4 g. of Ca, 0·3 g. each of Ca and Fe, 0·3 g. each of Fe and Ca, and 0·2 g. of As can be present for the same degree of accuracy. Filtration is unnecessary with <0·1 g. of Ca. When Al, Ca, and Fe are present fuming with H_2SO_4 after the HNO_3 treatment in the opening up of the ore is essential. L. S. T.

Volumetric titrations with potassium bromate. G. TRAVAGLI (Annali Chim. Appl., 1940, **30**, 122—126).—Cu_2Cl_2 is titrated by 0·1N-$KBrO_3$ to Me-orange (violet–blue colour change) in presence of HCl and CO_2. The method is applicable to other Cu salts and to the determination of reducing sugars. F. O. H.

Quantitative separation of metals by hydrogen sulphide. III. Separation of zinc from iron by hydrogen sulphide, and the induced precipitation of ferrous sulphide by zinc sulphide. IV. Separation of copper from thallium by hydrogen sulphide, and the induced precipitation of thallous sulphide by cupric sulphide. V. Separation of nickel, cobalt, and zinc from manganese. H. KATÔ (Sci. Rep. Tôhoku, 1940, **28**, 480—490, 491—499, 500—511; cf. A., 1935, 719).—III. Pptn. of FeS from $FeSO_4$ commences at p_H 3·3+ and is complete at p_H 4·36. FeS is pptd. on the surface of ZnS under conditions in which $[Fe^{\cdot\cdot}][S'']$ is < the solubility product. Evidence that this induced pptn. is due to adsorption is discussed. In practice, the safe p_H range for separating $Zn^{\cdot\cdot}$ from $Fe^{\cdot\cdot}$ as sulphide is 2·0—2·9; the most suitable p_H is 2·4. $CH_2Cl\cdot CO_2'$ buffer is preferred to formate. The solubility product calc. for FeS is $3{\cdot}6 \times 10^{-19}$.

IV. Pptn. of Tl_2S commences at p_H ~2, and is complete at p_H 4·32. The solubility product calc. is $6{\cdot}7 \times 10^{-23}$. Induced pptn. of Tl_2S on CuS occurs, and is due probably to adsorption. For the complete separation of $Cu^{\cdot\cdot}$ from $Tl^{\cdot}$, H_2S should be passed into solutions 2N. with respect to H_2SO_4 or N. with respect to HCl.

V. Pptn. of Mn commences at p_H ~5·3. The calc. solubility product is $4{\cdot}2 \times 10^{-15}$. The green form of MnS is not pptd. in acid solution, but transformation from pink to green occurs readily at p_H 9·5—10. Some induced pptn. of MnS with ZnS, CoS, or NiS can occur. The most suitable p_H ranges for separating Mn from Zn and from Co and Ni are 3—4 and 4·0—4·8, respectively. In practice, an excess of a buffer solution (AcOH–NaOAc) of p_H 4·4 should be added to the nearly neutral, unbuffered solution containing $Ni^{\cdot\cdot}$, $Co^{\cdot\cdot}$, and $Mn^{\cdot\cdot}$, heated to 70°, and saturated with H_2S. L. S. T.

Determination of small amounts of copper and manganese in dyes etc.—See B., 1940, 347.

Potentiometric examination of anticorrosive pigments.—See B., 1940, 377.

Detection and micro-determination of rare elements by luminescence. M. SERVIGNE (Bull. Soc. chim., 1940, [v], **7**, 121—132; cf. A., 1939, I, 58, 599).—The sample is dissolved in fused $CaWO_4$, which is subsequently powdered and distributed in a

thin layer on a Pyrex or SiO_2 tube. Its luminescence is excited by placing the specimen around a discharge tube, or, alternatively, by arranging it inside a discharge tube. In either case the temp. of the sample is maintained at 90—150° while the spectrum is photographed. The method permits the detection of 5—100 × 10^{-7} g. of rare earth metal in 1 g. of $CaWO_4$. Comparison of the intensity of the luminescence obtained with that obtained from standards can be used for the determination of small amounts of these metals. J. W. S.

Application of internal complex compounds in colorimetry (Determination of aluminium with the aid of aurintricarboxylic acid.) A. K. BABKO (J. Appl. Chem. Russ., 1939, **12**, 1560—1567).—The transition point of aurintricarboxylic acid (I) is at p_H 13·1. The absorption spectra of (I), its anion, and its Al salt are given. (I) is preferable to alizarin for the colorimetric determination of Al. R. T.

Spectrographic determination of small amounts of aluminium in iron and steel.—See B., 1940, 364.

Determination of manganese as pyrophosphate. B. MORSAN (Arh. Kemiju, 1939, **12**, 109—124).—1 c.c. of conc. H_2SO_4 and 15 c.c. of saturated aq. Na_2HPO_4 are added to 20 c.c. of solution, followed by aq. NH_3 to a faint pink colour (phenolphthalein). 200 c.c. of H_2O are added, and the suspension is heated for 3 hr. at 100°, the ppt. of $MnNH_4PO_4$ is collected, washed, ignited (850°), and weighed as $Mn_2P_2O_7$. R. T.

Ammonium persulphate reaction for manganese. P. G. POPOV (J. Appl. Chem. Russ., 1939, **12**, 1738—1739).—Under certain conditions S_2O_8'' oxidises Mn^{II} to Mn^{VII} in absence of $Ag^{\cdot}$; this reaction cannot therefore serve as a test for $Ag^{\cdot}$ except when a blank test is negative. R. T.

Rapid volumetric determination of iron and titanium; application to ilmenite analysis. P. R. SUBBARAMAN and K. R. KRISHNASWAMI (Proc. Indian Acad. Sci., 1940, **11**, **A**, 106—115).—A mixture containing Fe and Ti is reduced to Fe^{II} and Ti^{III}. Ti^{III} is determined by titration with $Fe_2(SO_4)_3$, and both Fe^{II} and Ti^{III} by $KMnO_4$. These methods have been applied to the analysis of ilmenite. W. R. A.

Potentiometric titration of iron. D. I. RJABTSCHIKOV and V. G. SILNITSCHENKO (J. Appl. Chem. Russ., 1939, **12**, 1907—1911).—Fe^{III} is reduced to Fe^{II} by means of CuCl, and the solution is titrated with standard $KMnO_4$ solution. R. T.

Oxidation–reduction indicators in qualitative analysis. Use of ferrous dimethylglyoxime. G. CHARLOT (Bull. Soc. chim., 1940, [v], **7**, 144—150).—Fe^{II} dimethylglyoxime (I) in aq. NH_3 is decolorised by MnO_4', OI′, IO_4', $Fe(CN)_6'''$, and S_2O_8'', thereby permitting the detection of these ions in the presence of ClO_3', VO_3', IO_3', BrO_3', AsO_4''', and ClO_4'. (I) in aq. NH_3, previously decolorised by oxidation, is regenerated by S_2O_4'' and S″, and can be used for detecting these ions in the presence of CN′, I′, PO_3''', PO_3'', SO_3'', S_2O_3'', or CH_2O. The reaction can also be used for the detection of $Ce^{\cdots}$, $Sn^{\cdot\cdot}$, and $VO^{\cdot\cdot}$. Small quantities of $Fe(CN)_6'''$ can be titrated with (I). J. W. S.

Test for cobalt. B. NILSSEN and A. PAULSEN (Tids. Kjemi, 1940, **20**, 52).—The sensitivity of the $(CMe:N\cdot OH)_2$–polysulphide test for Co is increased to at least 1 in 5 × 10^6 by oxidation to $Co^{\cdots}$ with H_2O_2 before addition of Na polysulphide. Filtration is preferable if Cu is present, but no common cation interferes. M. H. M. A.

Detection of nickel by a flotational reaction. I. M. KORENMAN and V. V. DUDNIK (J. Appl. Chem. Russ., 1939, **12**, 1742—1743).—Excess of $(CMe:N\cdot OH)_2$ in aq. NH_3 is added to 10 ml. of the solution, which is then shaken with 0·5 ml. of CCl_4. Ni ($\nless$5 μg.) is indicated by a red film forming at the phase interface. Co, Mn^{II}, Pb^{II}, Fe^{III}, Cr^{II}, Cr^{III}, Cu^{II}, Bi, Al, Zn, and Ag interfere. R. T.

Volumetric determination of tungsten. M. L. HOLT and A. G. GRAY (Ind. Eng. Chem. [Anal.], 1940, **12**, 144—146).—W^{VI} in conc. HCl is reduced to W^{III} at ~60° by liquid Pb–Hg in a reductor of special design. The W^{III} is at once reoxidised by aq. Fe^{III} NH_4 sulphate, and the Fe^{II} produced is titrated with $K_2Cr_2O_7$ (Ba diphenylaminesulphonate). The method is applicable to macro- and semi-micro-quantities. Test data and procedures for determining W in tungstate solutions, Fe–W, and electro-deposited W–Ni alloys are given. A Sn amalgam is unsatisfactory for the reduction. L. S. T.

New applications of the silver reductor. Determination of uranium and copper. N. BIRNBAUM and S. M. EDMONDS (Ind. Eng. Chem. [Anal.], 1940, **12**, 155—157; cf. A., 1938, I, 158).—The reduction of UO_2^{II} to U^{IV} in the Ag reductor is quant. in hot 4M-HCl. The U^{IV} is then titrated with 0·1M-$Ce(SO_4)_2$ at room temp. in presence of H_3PO_4, using *o*-phenanthroline–$Fe^{\cdot\cdot}$ complex (I) as indicator. Titrations in hot solution with this indicator are unsatisfactory (cf. A., 1933, 1025), but in presence of H_3PO_4 the reaction is rapid and the end-point sharp at room temp. AcOH (10 ml. per 50 of 4M-HCl) does not interfere, but HNO_3, Fe, Mo, V, and Cu must be absent. $Cu^{\cdot\cdot}$ is reduced quantitatively to $Cu^{\cdot}$ in the Ag reductor in 2M-HCl. The $Cu^{\cdot}$ is collected under Fe^{III} alum, and the $Fe^{\cdot\cdot}$ titrated with $Ce(SO_4)_2$ [(I)]. Zn, Sn, As^V, Bi, Cd, and comparatively large amounts of HNO_3 do not interfere; Fe, Mo, U, and V must be absent. L. S. T.

Determination of titanium in aluminium and in light alloys by absolute colorimetry.—See B., 1940, 368.

Determination of germanium by means of 8-hydroxyquinoline. I. P. ALIMARIN and O. A. ALEXEEVA (J. Appl. Chem. Russ., 1939, **12**, 1900—1906).—2 ml. of 5% aq. $(NH_4)_2MoO_4$ are added per mg. of GeO_2 present in 50 ml. of neutral solution, followed by 3 ml. of 10% H_2SO_4 and H_2O to 100 ml. 9 ml. of conc. HCl are added after 5 min., followed by 20 ml. of 2% 8-hydroxyquinoline in 12% AcOH, and the ppt. of $(C_9H_7ON)_4,H_4[Ge(Mo_{12}O_{40})]$ is collected after 3—12 hr., washed with a mixture of 7 ml. of conc. HCl with 25 ml. of 8-hydroxyquinoline

solution, and then with H_2O, dried at 110°, and weighed. The method gives trustworthy results for solutions containing 0·05—10 mg. Ge. R. T.

Detection of bismuth by a flotational reaction. I. M. KORENMAN and N. T. SOROKINA (J. Appl. Chem. Russ., 1939, **12**, 1740—1741).—2 ml. of 25% KI, a few crystals of Na_2SO_3, and a few drops of C_5H_5N are added to the solution, which is then shaken with 1 ml. of Et_2O; Bi ($\nless$8 μg.) is indicated by a yellow film forming at the phase interface. Al, Fe^{III}, Mn^{II}, Zn, Cd, Cu^{II}, Pb^{II}, Hg^{II}, Sn^{II}, Sb^{III}, and Ag interfere; in their presence Na_2SO_4 is added together with the Na_2SO_3, and the Et_2O layer with the pellicle is shaken with aq. Na K tartrate, the aq. layer is made acid with HCl, and the reaction is repeated ($\nless$0·15 mg. Bi). R. T.

Measurement of very small amounts of heat and very small changes of temperature. S. ZAMENHOF (Rev. Sci. Instr., 1940, **11**, 123—125).—The gas or vapour thermometer described detects temp. changes ~0·0001° and quantities of heat ~10^{-4} g.-cal. by observation through a microscope of the shift of the top of the meniscus due to changes in the shape of the meniscus while the circumference remains stationary. N. M. B.

[Determination of] thermal conductivity of gases by a relative method with an application to deuterium. W. G. KANNULUIK (Proc. Roy. Soc., 1940, **A**, **175**, 36—48).—The method consists of the use of a short, thick " hot wire " for which an approx. theory is given. The ratio of the conductivity of H_2 to that of D_2 at 0° is 1·365. G. D. P.

Direct calibration of a copper–constantan thermel for measurement of temperature differences at a series of temperatures. J. S. BURLEW and R. P. SMITH (J. Amer. Chem. Soc., 1940, **62**, 701—704).—A direct differential method of calibration is described. Vals. obtained by it for a Cu–constantan thermel are in complete agreement with those obtained for the same thermel by the integral method. W. R. A.

Resonance method for measuring the ratio of the specific heats of a gas, C_p/C_v. I. A. L. CLARK and L. KATZ (Canad. J. Res., 1940, **18**, **A**, 22—38).—The apparatus consists of two similar chambers separated by a steel piston which is caused to oscillate by an external alternating magnetic field, and γ is calc. from the resonance frequency. F. J. G.

Rhodium mirrors. M. AUWÄRTER (J. Appl. Physics, 1939, **10**, 705—710).—Rh forms an adherent and hard film not subject to either physical or chemical ageing and with relatively const. reflecting power throughout the visible spectrum. Semi-transparent Rh mirrors can be used to reduce light intensity without change in λ-distribution. O. D. S.

New methods in spectroscopy. G. R. HARRISON (Science, 1940, **91**, 225—228).—An address. L. S. T.

Iron arc as a standard source for spectrochemical analysis. M. SLAVIN (Ind. Eng. Chem. [Anal.], 1940, **12**, 131—133; A., 1938, I, 535).—The form of the arc, an Fe bead placed between graphite electrodes, the method of using it as a standard, and applications of its use are described. L. S. T.

Monochromator for spectrophotometric investigations. E. STROHBUSCH (Z. Instrumkde., 1939, **59**, 417—421).—The optical system is described. A. J. M.

Generalisation of the Bragg–de Broglie method of focussing for application to double-crystal X-ray spectrographs. H. T. PLASENCIA (Compt. rend., 1940, **210**, 395—398).—Conditions for Bragg focussing with two parallel crystals, reflecting from their principal faces or planes perpendicular to a cleavage plane, are derived. The use of a divergent beam renders a collimating system unnecessary, and high luminosity is obtained without loss of resolving power. A. J. E. W.

Concave spherical crystals of barium copper stearate for use in long wave-length X-ray spectrometers. C. L. ANDREWS (Rev. Sci. Instr., 1940, **11**, 111—114).—To diffract and focus a monochromatic beam of X-rays, multiple unimol. layers of Ba Cu stearate were deposited on an accurately ground concave spherical glass surface. With a spherical crystal of radius 218 cm., grating space ~50·5 A., photographs of the Al $K\alpha,\beta$ region (unresolved) were obtained in 30 min. at 3 kv. and 15 ma. The intensity and resolving power from the grating are probably adequate for measurements of absorption coeffs. at λλ. >8 A. with an ionisation chamber. N. M. B.

Setting crystals for single-crystal X-ray photographs. M. ARNFELT (Arkiv Kemi, Min., Geol., 1939, **13**, **B**, No. 9, 7 pp.).—The method is based on the principle of the reciprocal lattice; the technique is slightly different from that of Bernal (A., 1927, 9). T. H. G.

Two-crystal Weissenberg X-ray goniometer. W. A. WOOSTER and A. J. P. MARTIN (J. Sci. Instr., 1940, **17**, 83—89).—The standard and unknown crystal are both arranged on the axis of the cylindrical camera and reflexions from both obtained on the same film. In this way fluctuations of X-ray output and variations in the sensitivity and development of the film do not affect the determination of relative intensity of reflexion. D. F. R.

Very sensitive thermo-element for the determination of radiation. G. ROSENTHAL (Z. Instrumkde., 1939, **59**, 432—439, 457—463).—Details of construction are given. A. J. M.

Evaluation of radiation intensities by a simplified spectrographic method. A. J. MADDOCK (J. Sci. Instr., 1940, **17**, 89—92).—The radiation is reflected from a MgO screen on to a quartz spectrograph and the spectrum compared with a series of spectra obtained similarly from a standard source of radiation, the intensity of the latter being varied in steps of 10%. Visual comparison of corresponding λλ may be made with an accuracy of 5—10%, and the summation of the whole intensities with an accuracy of ~3%. D. F. R.

Theory of crossed slit method of observation [of concentration gradients]. H. SVENSSON (Kolloid-Z., 1940, **90**, 141—156; cf. A., 1939, I, 370).—

The sensitivity of the method and various sources of error are treated mathematically. The use of the different lenses is discussed and the setting-up and adjustment of the apparatus are described. F. L. U.

Photo-electric micro-photometer. M. VERAIN (Atti X Congr. Internaz. Chim., 1938, IV, 478—481). F. O. H.

Photo-effect and its application in photo-cells. H. VERLEGER (Z. Instrumkde., 1939, **59**, 396—415).—A review. A. J. M.

Null-type photo-electric spectrophotometer. C. J. BARTON and J. H. YOE (Ind. Eng. Chem. [Anal.], 1940, **12**, 166—168).—Details of construction and operation of an instrument employing barrier-layer photo-cells, and tests of accuracy, sensitivity, and reproducibility, are given. The apparatus can be used for accurate spectrophotometric measurements, the study of colorimetric methods of analysis, and other types of absorption measurements. L. S. T.

Photo-electric cells sensitive to long-wave length radiation. Bismuth sulphide cell.—See B., 1940, 371.

Photo-electric micro-densitometer. M. SPIEGEL-ADOLF and R. H. PECKHAM (Ind. Eng. Chem. [Anal.], 1940, **12**, 182—184).—The apparatus described consists mainly of a light source, a microscope stand, and a photo-electric cell; it permits graphical descriptions of *X*-ray diffraction patterns to be given. L. S. T.

Synchronising the illumination for an ultra-centrifuge. Y. BJÖRNSTÅHL (J. Sci. Instr., 1939, **16**, 254—256).—An ultracentrifuge suitable for the optical measurement of sedimentation velocities is described. A light source of const. intensity is interrupted by means of a rotating aperture disc, and two methods of synchronising this disc with the centrifuge are described. C. R. H.

New results with luminescent substances and their use. N. RIEHL (Chem.-Ztg., 1940, **64**, 8—11; cf. A., 1939, I, 124).—A review of new applications of luminescent substances, including the production of more sensitive ZnS fluorescent screens and of luminescent photographic emulsions, for use in *X*-ray and related technique; also the development of new forms of white and coloured lighting by means of discharge tubes coated with new luminescent substances, *e.g.*, Zn_2SiO_4–$CaWO_4$. The night illumination of external chemical plant, in the absence of normal lighting, by means of luminous paint and ultra-violet light, is described. D. F. R.

(A) **Development of the electron microscope.** L. C. MARTIN, D. H. PARNUM, and G. S. SPEAK. (B) **Optics of the electron microscope.** L. C. MARTIN (J. Roy. Microscop. Soc., 1939, [iii], **59**, 203—216, 217—231).—(A) Testing, modifications, and adjustments of the apparatus previously described (cf. A., 1937, I, 152) are reported. Possible causes of residual effects and attempted methods for their elimination are summarised under 11 heads.

(B) A detailed consideration of the causes of "streaking" in the images, and a brief reference to the effect of spherical aberration on the resolving limit and to depth of focus. N. M. B.

Dropping electrode with a constant head of mercury. E. F. MUELLER (Ind. Eng. Chem. [Anal.], 1940, **12**, 171)—A Hg reservoir using the principle of the Mariotte flask is sealed on to the dropping electrode, and maintains a const. head of Hg in polarographic measurements. L. S. T.

Temperature corrections in p_H determinations with the glass electrode. O. NYNÄS (Finska Kem. Medd., 1939, **48**, 129—138).—Temp. correction is discussed mathematically. The correction factor, ΔE, is most easily obtained graphically from measurements of dp_H/dt, apparent and real, of buffer solutions of widely separated p_H. $\Delta E \propto p_H$ over a wide range. M. H. M. A.

Mercury cathode in metallurgical analysis.—See B., 1940, 367.

Electric moments of molecules. M. E. HOBBS, J. W. JACOKES, and P. M. GROSS (Rev. Sci. Instr., 1940, **11**, 126—133).—On the basis of the Debye expression, determinations of mol. polarisation over a small temp. interval with an apparatus giving high precision measurements of ϵ and its dependence on temp. is a method of obtaining an accurate val. of the dipole moment of gaseous polar substances. The apparatus described consists of oscillators, a measuring condenser operated by a 1-m. arm carrying at one end a micrometer microscope, a high-capacitance gas condenser and fixed reference capacitance, a vapour thermostat with manostat to control the temp. of the gas condenser, and high-precision pressure-measuring gauges. N. M. B.

Action of the Geiger–Müller counter. C. H. COLLIE and D. ROAF (Proc. Physical Soc., 1940, **52**, 186—190).—In view of the uncertainty as to the action mechanism, an investigation of the working of a counter filled with He and EtOH vapour was made. Results, combined with available data, show that ionisation by collision is the dominant process over a large voltage range. N. M. B.

Ten-litre volumetric flask. E. J. REITHEL (Ind. Eng. Chem. [Anal.], 1940, **12**, 159).—Vols. of ~10 l. can be measured with an accuracy of ±5 ml. by using a graduated pipette as a vol. indicator in the manner described. The pipette is adjusted so that it touches the surface of the liquid contained in a 12-l. bottle. L. S. T.

Carbonate–veronal buffer solution covering p_H 7·5 to 10·7. E. J. KING and G. E. DELORY (Enzymologia, 1940, **8**, 278—279).—25 c.c. of 0·1M-Na veronal are added to the appropiate amount of 0·1N-HCl in a 100-c.c. flask, followed by 25 c.c. of 0·1M-Na_2CO_3. The contents are mixed and diluted to 100 c.c. When stored in well stoppered paraffin-waxed bottles the buffers retain their p_H val. for ≮10 months. J. N. A.

Universal buffer mixture. H. T. S. BRITTON (Analyst, 1940, **65**, 220).—Johnson and Lindsey's (A., 1939, I, 482) modification of Britton and Robinson's universal buffer mixture (A., 1931, 910). has already been adopted by Britton and Welford (A., 1938, I, 34). E. C. B. S.

Apparatus for the Kjeldahl determination of nitrogen. H. LECOQ (Bull. Soc. Chim. biol., 1940,

22, 112—113).—The vessel containing the NH_3 is placed inside the steam generator. A. L.

Motorised apparatus for rapid determination of calcium and magnesium in water.—See B., 1940, 413.

Apparatus for determination of hardness of water by the Boutron–Boudet method.—See B., 1940, 331.

Weighing bottle. W. A. Taebel (Ind. Eng. Chem. [Anal.], 1940, **12**, 141).—The bottle consists of a glass tube into which a funnel is sealed; the stem of the funnel is closed by a ground-glass stopper. Liquids or finely-divided or fluffy solids can be transferred directly to a vessel without loss. L. S. T.

Sealable absorption micro-tube. A. N. Prater (Ind. Eng. Chem. [Anal.], 1940, **12**, 184).—The modified Friedrichs tube described and illustrated weighs <15 g. when full and contains sufficient absorbent for 25 analyses. Larger tubes of the same design are suitable for semi-micro-determinations. L. S. T.

Magnetic shaking device. S. Kiyomizu (Ind. Eng. Chem. [Anal.], 1940, **12**, 174).—A device for shaking samples in a thermostat is described and illustrated. L. S. T.

All-glass ball valve stirrer. S. Liotta (Ind. Eng. Chem. [Anal.], 1940, **12**, 173).—The stirrer has a hollow glass ball inside a cylindrical moving piston, and provides a slow-motion type of stirring with a positive flow of solution from bottom to top. Constructional details of the stirrer and a method of seating it in a Dewar container are illustrated. L. S. T.

Flow divider for gases. J. H. Bruun (Ind. Eng. Chem. [Anal.], 1940, **12**, 172).—The apparatus described and illustrated divides the main gas stream into desired proportions by varying the resistance of a capillary tube to gaseous flow by inserting a wire of suitable size in the capillary. L. S. T.

Reduction of specific gravity at 25°/25° to density at any temperature from 0° to 40°. R. R. Dreisbach (Ind. Eng. Chem. [Anal.], 1940, **12**, 160—161).—A graphical method of interpolation, applicable when the coeff. of cubic expansion of the liquid is known, is described. L. S. T.

Apparatus for Pregl–Beckmann micro-determination of mol. wt. K. Bürger (Chem. Fabr., 1940, **13**, 54—55).—An apparatus using 1·5 c.c. of solvent and 5—7 mg. of solute and incorporating a Hoeppler ultrathermostat is described and claimed to give results <1% in error. J. A. S.

Determination of maximum pore size of filters. H. Knöll (Kolloid-Z., 1940, **90**, 189—194).—The interpretation of results given by the max. bubble pressure method as applied to filters is discussed. Further experiments with bacterial filters and single capillaries show that Bechhold's method gives vals. for the max. pore size of filters about half the real vals. The bubbles first appearing at filters when the pressure is gradually raised are not formed by the coalescence of smaller bubbles from neighbouring pores. F. L. U.

Filters with pores of known and equal size down to the size of colloidal particles. J. Berndel (Kolloid-Z., 1940, **90**, 194—196).—The filters are made by fusing together at a temp. low enough to prevent collapse of the bore glass capillaries in bundles of 7. The composite capillary rods thus formed are then drawn out so as to reduce the pore diameter to $\frac{1}{4}$ of its initial val., and the processes of bundling and drawing out are repeated as often as required. In this way a rod having 7^6 parallel cylindrical pores of $\sim$0·25 μ. diameter has been made. F. L. U.

Cold extraction apparatus. J. Benotti (Science, 1940, **91**, 223—224). L. S. T.

Simple apparatus for extraction of liquids with light and heavy solvents. J. Pritzker and R. Jungkunz (Pharm. Acta Helv., 1939, **14**, 223—225).—The apparatus, which is similar to a Soxhlet apparatus without the siphon tube, is figured. A glass tube, leading from a tap at the bottom of the extraction tube to about the middle of the vapour tube, conveys heavy solvent. Light solvent condensate drops through a funnel with a long stem which is sealed at the bottom and perforated at the side, to the bottom of the liquid, through which it rises, and returns through the vapour tube. E. H. S.

Closing the compression capillary of a McLeod gauge. W. F. C. Ferguson (Rev. Sci. Instr., 1940, **11**, 134).—Distortion of the bore is avoided by fusing in a slightly tapered solid glass rod plug squarely cut or ground off at the inner end. N. M. B.

Vacuum leak testing. E. J. Lawton (Rev. Sci. Instr., 1940, **11**, 134; cf. Manley, A., 1940, I, 134).—Painting a leak with CCl_4 caused sharply increased electron emission and directing a stream of O_2 or H_2 at the tube caused decreased emission of a W filament ion gauge. The emission change is a more sensitive and satisfactory method of leak detection than measurement of the ion current. The effect of hydrocarbon vapours from stopcock grease is discussed. N. M. B.

Sensitive automatic pressure control device. R. A. Smith (Rev. Sci. Instr., 1940, **11**, 120—122).—Control with a Pirani gauge at pressures down to 0·01 μ. and sensitive to 0·01—0·02 μ. is obtained by passing a current through the Pirani tube and interpreting the pressure from the resistance measured by a bridge. The bridge balance is connected to an electronic circuit controlling a vac. pump which comes into action if resistance falls. N. M. B.

New method for measuring Young's modulus. A. King (Rev. Sci. Instr., 1940, **11**, 114—116).—For a rapid simple dynamic method the specimen, in the form of a circular loop of wire of radius r, is fastened at one point to a rigid support and at the diametrically opposite point a magnetic field is applied. The frequency of an a.c. in the loop is adjusted until flexural vibrations occur in the plane of the loop. Then the resonance frequency f, linear density m, and radius of the wire a are related to Young's modulus by $E = 18{\cdot}395mf^2(r/a)^4(1-g)$ where $(1-g)$ is a gap correction factor. N. M. B.

[**Laboratory apparatus.**] J. A. DE BRUIJN, jun. (Chem. Weekblad, 1940, **37**, 249—252).—(i) An improved gas wash-bottle consists of a cylindrical vessel with a long, bell-shaped inlet and a narrow outlet, both of which are fitted with spherical splash heads. (ii) I is sublimed by heating a mixture of I (10), KI (5), and CaO (3—4 parts) in a slow stream of N_2, passing the vapours over CaO + KI at 200—250°, and condensing the sublimate in a spherical, water-cooled bulb attached directly (ground joint) to the sublimation tube. (iii) Various forms of Soxhlet-type extraction apparatus are discussed; the preferred form has a filter-plate in place of a siphon and is fitted with a two-way tap immediately below the extraction chamber to facilitate the taking of samples of the extract during extraction. (iv) Ground-in condensers are not satisfactory in determinations of the maleic acid val. and better results are obtained with 250-c.c. Erlenmeyer flasks with long necks (25 × 2·0 cm.), which can be surrounded during the heating period by closely fitting, externally cooled jackets (20 × 2·1—2·2 cm.). (v) A modified Waterman–Elsbach apparatus for distillation of small amounts of liquid in a cathode-light vac. is also described. S. C.

Viscosimeter for volatile liquids. A. TOROPOV (J. Appl. Chem. Russ., 1939, **12**, 1744). R. T.

Modified Kendall tube for purifying nitrogen. G. M. SAVAGE and Z. J. ORDAL (Science, 1940, **91**, 222—223).—The modification (cf. A., 1931, 809) illustrated provides for more intimate contact between gases and Cu gauze, and increases greatly the capacity for removal of O_2. L. S. T.

Still for producing metal-free distilled water. J. S. MCHARGUE and E. B. OFFUTT (Ind. Eng. Chem. [Anal.], 1940, **12**, 157—159).—A still with quartz condenser tubes is described and illustrated. The H_2O contained <1 part of metal per billion. L. S. T.

All-glass still witb automatic float feed. G. F. LIEBIG, jun. (Ind. Eng. Chem. [Anal.], 1940, **12**, 174).—An electrically-heated Pyrex still, which produces ~500 ml. of redistilled H_2O per hr. and operates for long periods without attention, is described and illustrated. L. S. T.

Fractional distillation.—See B., 1940, 332.

Separation of isotopes. E. H RIESENFELD (Arkiv Kemi, Min., Geol., 1939, **13**, **A**, No. 16, 11 pp.). —An "open" modification of the Hertz diffusion apparatus for the separation of gaseous isotopes is described. Fresh supplies of the mixture to be separated can be introduced continuously, thus permitting the collection of large quantities of the enriched fractions of both light and heavy isotopes. In the open apparatus the separation process need not be carried out without interruption, a smaller no. of diffusion units is needed, and more rapid and more complete separation is achieved. The use of Boltwood Hg pumps instead of diffusion pumps is discussed. T. H. G.

Apparatus for catalytic dehydration of alcohol to olefine.—See B., 1940, 332.

Geochemistry.

Metastable γ-phase of Fe_2O_3 in some samples of magnetite undergoing change. V. MONTORO (Atti X Congr. Internaz. Chim., 1938, II, 736).—*X*-Ray measurements show the presence of the metastable γ-Fe_2O_3 together with Fe_3O_4 in samples of polarised magnetite from the island of Elba. O. J. W.

Isotopic composition of oxygen in carbonate rocks and iron oxide ores. M. DOLE and R. L. SLOBOD (J. Amer. Chem. Soc., 1940, **62**, 471—479).—Improved apparatus for density measurements (described) has been used in the isotopic analysis of O in carbonate rocks and Fe oxide ores. Carbonates of different geological age (Grenville marble, Niagara dolomite, Pennsylvania limestone and clam shells) give approx. the same isotopic composition of the O. When the O in Grenville marble is liberated as CO_2 with acid and reduced with H_2 it gives H_2O of *d* 9·2 p.p.m. > normal, but if the CO_2 is liberated by heat the resulting H_2O is only 7·9 p.p.m. > normal. This variation is attributed to the isotopic fractionation which occurs when the CO_3'' ion is decomposed by acid. The val. 7·9 p.p.m. can be explained quantitatively on the isotopic exchange equilibrium theory of Urey and Grieff (A., 1935, 446). The O in Fe oxide ores of the Keewatin and Middle Huronian ages does not differ significantly in its isotopic composition from that of O in normal H_2O. Any deviations are probably due to the presence of carbonates in the ores. W. R. A.

Italian bentonite. F. SAVELLI (Atti X Congr. Internaz. Chim., 1938, II, 785—795).—The chemical and mineralogical composition of Italian bentonite (I) from Ponza I. is compared with that of American bentonite from Wyoming. The swelling, plastic, adsorption, and thixotropic properties of (I) are described. O. J. W.

Distribution of indium in rocks. S. A. BOROVIK, N. M. PROKOPENKO, and T. L. POKROVSKAJA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **25**, 618—621).—The In content of numerous rocks and clays from various parts of the U.S.S.R. has been determined spectroscopically. In is found in acid, intermediate, and partly alkaline rocks, *e.g.*, granites, monzonites, and nepheline syenites, but is absent from basic rocks, *e.g.*, gabbro and dunite. The average In content is ~5×10^{-6}%. C. R. H.

Coal veins in Malaya. (SIR) L. L. FERMOR (Geol. Mag., 1939, **76**, 465—472).—Vitrain veins deposited vertically in alluvium at Bidor are described. They demonstrate that vitrain, a gel, can be deposited from solution by a colloidal process, and is not merely the result of the alteration of carbonaceous matter *in situ*. L. S. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

JULY, 1940.

Absorption of the hydrogen line 1215·7 A. by air. W. M. PRESTON (Nature, 1940, **145**, 623—624).—A discussion of the large discrepancy between the author's val. and that of Williams (A., 1940, I, 137) for the coeff. of absorption in O_2 and air.
L. S. T.

Continuous absorption of light by negative hydrogen ions. H. S. W. MASSEY and D. R. BATES (Astrophys. J., 1940, **91**, 202—214).—Theoretical.
L. S. T.

Second positive band system of nitrogen. R. C. PANKHURST (Proc. Physical Soc., 1940, **52**, 388—389).—New measurements, accurate to 0·1 A., for λλ of the heads of the whole system are tabulated and briefly discussed. N. M. B.

New afterglow phenomenon. J. KAPLAN (Physical Rev., 1940, [ii], **57**, 662).—A comparison of the early and late phases of a N_2 afterglow at ~20 mm. shows that the forbidden N_2 line λ 3467, corresponding with the ^2P—^4S transition, is much more intense compared with the second positive N_2 bands late in the glow than in the early part. The ratio of forbidden to allowed radiation increases unexpectedly with pressure. Results show that the spectrum of the late phase corresponds with that of the early phase of a higher-pressure afterglow, or the effect on the spectrum of the afterglow as its lifetime increases is that of an apparent increase in pressure.
N. M. B.

Origin of the yellow line in twilight and the night sky luminescence. E. TÖNSBERG and L. VEGARD (Nature, 1940, **145**, 588—589).—Spectrograms of twilight in which the two components of the yellow line are separated have been obtained. This doublet is identical with the D_1D_2 doublet of Na.
L. S. T.

Atmospheric layer from which the yellow line in twilight originates. L. VEGARD (Nature, 1940, **145**, 623).—Spectrograms taken in the zenith and horizontally show that the yellow line of twilight comes from a layer in the lower part of the auroral region. An extra-terrestrial origin of the Na, possibly from the sun, is indicated. L. S. T.

Absorption of the yellow line of the twilight spectrum by sodium vapour. A. KASTLER (Compt. rend., 1940, **210**, 530—532).—The intensity of the D lines in the twilight sky spectrum is reduced by passing the light through a 3-cm. cell containing Na vapour, and the lines disappear if the Na temp. is >200°. The breadth of the lines, which represents approx. the Doppler effect corresponding with the temp. interval 100—300°, is ~0·03 A. A. J. E. W.

Spark spectrum of silver. E. RASMUSSEN (Physical Rev., 1940, [ii], **57**, 840—841; cf. A., 1940, I, 137).—Intensities, λλ, wave nos., and classifications for 29 new lines obtained with a hollow cathode of pure Ag in a Ne discharge are tabulated. The strongest lines consist of doublets with separations 0·05—0·06 cm.$^{-1}$, explained as an isotopic displacement caused by the two s electrons, on the probable assumption that the origin of the new levels is the $4d^85s^2$ configuration. The enhancement of the combinations with the new levels is explained by a resonance effect of collisions of the second kind between Ne ions and Ag atoms. N. M. B.

Electrical quadrupole moment of the deuteron. Radiofrequency spectra of HD and D_2 molecules in a magnetic field. J. M. B. KELLOGG, I. I. RABI, N. F. RAMSEY, jun., and J. R. ZACHARIAS (Physical Rev., 1940, [ii], **57**, 677—695; cf. A., 1939, I, 176).—The mol. beam magnetic resonance method was applied to the study of the radiofrequency spectra, and all measurements were made in applied magnetic fields large enough to decouple the angular momentum vectors concerned. The spectrum of D_2 for the transitions $m_I = \pm 1$ consists of 6 lines as in H_2. The HD spectrum consists of a set of 9 lines in the region of the Larmor frequency of the proton, and a set of 12 lines in that of the deuteron. From the analysis of these results the existence in the deuteron of an electrical quadrupole moment, Q ($= 2{\cdot}73 \times 10^{-27}$ sq. cm.), must be assumed. The calc. spin-orbit interaction consts. are: H' (D_2) 14·0±0·6; H_D' (HD) 20·1±1; H_P' (HD) 20·48±0·2 gauss; these consts. represent the magnetic field produced by the mol. rotation at the position of a nucleus.
N. M. B.

Radiofrequency spectra of atoms. Hyperfine structure and Zeeman effect in the ground state of ^{6}Li, ^{7}Li, ^{39}K, and ^{41}K. P. KUSCH, S. MILLMAN, and I. I. RABI (Physical Rev., 1940, [ii], **57**, 765—780; cf. A., 1939, I, 297).—The mol. beam magnetic resonance method is extended to the study of atoms. Transitions between the members of hyperfine structure multiplets of the ground state were observed directly and led to high-precision measurements of the hyperfine structure intervals ^{6}Li 0·007613, ^{7}Li 0·026805, ^{39}K 0·015403, and ^{41}K 0·008474 cm.$^{-1}$ These spectra were observed in external magnetic fields of 0·05—4000 gauss; the lines are completely resolved even at the low fields, and the separations derived from measurements at different fields are in good agreement. The comparative ratio of the nuclear moments of ^{7}Li and ^{6}Li as derived from the

hyperfine structure measurements is 3·9610 and the directly measured ratio 3·9601. N. M. B.

Electric quadrupole moments of ^{69}Ga and ^{71}Ga. Atomic beam study of the hyperfine structures of $^2P_{1/2}$ and $^2P_{3/2}$ states of ^{69}Ga and ^{71}Ga. N. A. Renzetti (Physical Rev., 1940, [ii], **57**, 753—765).—An investigation by the zero-moment method of at. beams gives 6 zero-moment peaks, 3 for each isotope, of the metastable state and 2, one for each isotope, of the ground state. An equation for the hyperfine structure levels for the higher state is given and consts. are evaluated. From these the separations are ^{69}Ga 0·0362 $\pm$ 0·0007 and ^{71}Ga 0·0474 $\pm$ 0·0007 cm.$^{-1}$, and the quadrupole moments are 0·20 $\times$ 10^{-24} and 0·13 $\times$ 10^{-24} sq. cm., respectively. The nuclear spins are 3/2. The zero-moment peaks of the normal state give $\mu_{71}/\mu_{69} = \Delta\nu_{71}/\Delta\nu_{69} =$ 1·270 $\pm$ 0·006, and these separations are ^{69}Ga 0·0897 $\pm$ 0·0011 and ^{71}Ga 0·1139 $\pm$ 0·0019 cm.$^{-1}$ From these the nuclear moments are 2·11 and 2·69, respectively. N. M. B.

Intensity variations of bright hydrogen lines in the spectrum of γ Cassiopeiæ. T. M. Lin (Compt. rend., 1940, **210**, 561—563).—Variations in the intensities of the β, γ, δ, ε, and ζ H lines, relative to the adjacent sections of continuum, have been studied between August, 1936, and August, 1939. The observed variations are generally in the opposite sense to simultaneous changes in the mean brightness of the star. A. J. E. W.

Interpretation of nebular red-shifts. K. R. Popper (Nature, 1940, **145**, 701).—A correction (cf. A., 1940, I, 137). L. S. T.

Continuous spectrum of *Go* type stars. D. Chalonge and G. Déjardin (Compt. rend., 1940, **210**, 558—560; cf. A., 1940, I, 184).—The intensity of the continuum has been measured in certain regions relatively free from lines (notably at 4504, 4087·5, and 3301 A.) in the stellar spectra (3000—4500 A.). The following mean colour temp. are derived: η Boötis, ζ Herculis (type *dGo*), 5900°; α Aurigæ (*gGo*), 4650° K. A. J. E. W.

$L\alpha$ satellite lines for elements Mo (42) to Ba (56). C. A. Randall and L. G. Parratt (Physical Rev., 1940, [ii], **57**, 786—791; cf. A., 1938, I, 424).—An investigation with a two-crystal vac. spectrometer of the *X*-ray satellite lines accompanying $L\alpha_{1,2}$ emission leads to integrated relative intensities of the satellite group in qual. agreement with previous photographic measurements but differing by a factor of ~6. The abrupt intensity change at $Z = 50$ further confirms the Coster–Kronig interpretation of Auger production of the initial state in satellite emission. The absence of the abrupt intensity change at $Z = 50$ of components farthest removed from the $L\alpha_1$ line is discussed. N. M. B.

Double ionisation by the Auger effect: cause of a satellite intensity anomaly for the *X*-ray diagram line $M\alpha_1$. F. R. Hirsch, jun. (Physical Rev., 1940, [ii], **57**, 662—663).—Photographs showing the predicted anomaly (cf. A., 1936, 1169) are given and discussed. The intensity of the satellite group on the short-λ side of each $M\alpha$ line increases from $Z = 78$ (Pt) to a max. due to the Auger effect at approx. $Z = 82$ (Pb). N. M. B.

Photo-electric and optical properties of sodium and barium. R. J. Maurer (Physical Rev., 1940, [ii], **57**, 653—658).—Using polarised and unpolarised radiation, spectral distribution curves for Na and Ba were obtained. The work functions found were Na 2·28, Ba 2·48 e.v. Comparison of results with the Mitchell theory shows that it fails to account satisfactorily for the abs. photo-electric yields and for the yield ratio with radiation polarised parallel and perpendicular to the plane of incidence. N. M. B.

Secondary emission from films of silver on platinum. A. E. Hastings (Physical Rev., 1940, [ii], **57**, 695—699).—Total secondary emission and energy distribution of secondary electrons for films of known thickness of Ag on Pt were measured. The depth of origin of the total secondary emission as a function of primary energy, and the depth of origin of secondaries having a given energy were determined. Almost all secondaries from 20-e.v. primaries originate at <15 at. layers depth, and those from 50-e.v. primaries at <30 at. layers depth. For higher primary energies, appreciable emission comes from a depth >150 at. layers. Secondaries with energies close to that of the primaries originate at a depth small compared with that of the low-energy secondaries. N. M. B.

Theory of secondary emission from semi-conductors. E. M. Zenter (Mém. Physique, Kiev, 1940, **8**, 167—174).—Production of secondary electrons is considered as a process of ionisation of atoms of the dielectric, affecting the whole of the semi-conducting layer of a composite cathode. The val. of the coeff. of secondary emission is determined chiefly by the no. of low-velocity electrons. R. T.

Study of the surface structure of thoriated tungsten by means of an ionic microscope. N. D. Morgulis (Mém. Physique, Kiev, 1940, **8**, 149—153).—The Th film is shown to be discontinuous. R. T.

Theory of spark discharge. J. M. Meek (Physical Rev., 1940, [ii], **57**, 722—728).—The breakdown of a uniform field is considered to occur by the transition of an electron avalanche from cathode to anode into a self-propagating streamer which develops from anode to cathode to form a conducting filament between the electrodes, the criterion being that a streamer will develop when the radial field about the positive space charge in an electron avalanche attains a val. of the order of the external applied field. Photo-electrons in the vicinity will then be drawn into the stem of the avalanche and will give rise to a conducting filament of plasma, and the self-propagating streamer proceeds towards the cathode. An equation for breakdown is developed and calc. breakdown potentials in air show satisfactory agreement with experiment. Deviations of the theory from Paschen's law are within the limits of experimental error. Classical theory applies as a limiting case for low vals. of pressure $\times$ gap. N. M. B.

Method of plotting electron distribution curves for the *F* layer. C. W. McLeish (Canad. J. Res., 1940, **18**, A, 98—103). O. D. S.

Theory of multiple scattering of electrons. J. H. Bartlett, jun. (Physical Rev., 1940, [ii], **57**, 843; cf. Goudsmit, A., 1940, I, 185).—Mathematical. A solution, subject to the boundary condition of no scattering at zero thickness, is found for Bothe's formulation of the Boltzmann equation governing the change of angular distribution with thickness of scatterer. N. M. B.

Recombination of small and large ions in gases at high pressures. W. R. Harper (Phil. Mag., 1940, [vii], **29**, 434—448).—A rigorous derivation of the recombination coeff. (α) is given for both small and large ions at high pressures. For small ions the formula reduces to that of Langevin, and α is independent of concn. for concns. $\gg$ those produced by an α-particle at 100 atm. L. J. J.

Cross-section for change of charge and ionisation by high-velocity metallic ions in hydrogen and helium. C. W. Sherwin (Physical Rev., 1940, [ii], **57**, 814—821).—The method developed allowed the primary ionisation and change of charge effects of a beam of positive ions to be studied separately. Cross-sections are tabulated for Be^+, B^+, B^{++}, C^+, C^{++}, Al^+, Al^{++}, K^+, Fe^+, Fe^{++}, Fe^{+++}, Cu^+, Cu^{++}, and Cu^{+++} moving through H_2 and He with velocities corresponding with 6000—24,000 v. accelerating potential. The energies of ions formed in the gas by primary ionisation were ~10 e.v. and those of ions formed by the change of charge process were ~0·1 e.v. The cross-sections depend on the type of ion and accelerating voltage, and were <0·01—23 × 10^{-16} for H_2 and <0·01—10 × 10^{-16} sq. cm. for He. N. M. B.

Photophoresis of small particles in a magnetic field. F. Ehrenhaft (Physical Rev., 1940, [ii], **57**, 659).—In a homogeneous vertical magnetic field, particles move, when irradiated by intense light, in the direction of the magnetic lines of force as if they were single magnetic north or south poles (magneto-photophoresis). Intense light thus apparently produces single poles on every particle, and between these "magnetrodes" a real magnetic current flows. The single-pole hypothesis explains the behaviour of these particles and the form of the corona of the sun. N. M. B.

Isotope separation by transient pressure diffusion. E. J. Hellund (Physical Rev., 1940, [ii], **57**, 743—744).—Mathematical. The separation of mols. of nearly equal masses is investigated in connexion with the Loschmidt experiment. Results are obtained by a perturbation treatment of the continuity equations for a ternary mixture. N. M. B.

At. wt. of phosphorus. Analysis of phosphorus oxybromide. O. Hönigschmid and F. Hirschbold-Wittner (Z. anorg. Chem., 1940, **243**, 355—360).—From the ratios $POBr_3 : 3Ag$ and $POBr_3 : 3AgBr$ the at. wt. of P is 30·974. F. J. G.

Measurement, in Röntgens, of the gamma radiation from radium by the free-air ionisation chamber. L. S. Taylor and G. Singer (J. Res. Nat. Bur. Stand., 1940, **24**, 247—268).—Measurements with a pressure ionisation chamber at 1—10 atm. indicate that the intensity of the γ-ray emission from Ra is 8·16 r. per mg. per hr. at a distance of 1 cm. J. W. S.

Scattering of fast electrons by nitrogen nuclei. M. D. Borisov, V. P. Brailovski and A. I. Leipunski (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 142—143).—Photographs of tracks of fast electrons from a Ra source in a cloud chamber containing N_2 show a no. of collisions with scattering through >20°, in approx. agreement with the no. predicted by Mott's theory (cf. A., 1929, 861). L. J. J.

Relative probability for the loss of neutrons and α-particles from an excited nucleus. J. M. Cork and J. Halpern (Physical Rev., 1940, [ii], **57**, 667—668).—Pure Fe foils were bombarded with 10-Me.v deuterons, and excitation curves were obtained for $^{54}Fe (D, \alpha) ^{52}Mn$ (21 min.) and $^{54}Fe (D, n) ^{55}Co$ (18 hr.) (cf. A., 1939, I, 443). The radioactive yields give the relative escape probability neutron/α-particle from the same excited nucleus; at 10 Me.v. this ratio is 3 : 1. N. M. B.

Anomalous scattering of fast neutrons. M. R. MacPhail (Physical Rev., 1940, [ii], **57**, 669—676; cf. Zinn, A., 1939, I, 504).—The neutron scattering cross-sections of Al, Mg, C, Na, and N (NaN_3) were measured as a function of neutron energy in the range 2·34—2·80 Me.v. Anomalous vals. were found for Mg and Al. The anomaly is discussed on the basis of available theory, and, in the case of Mg, is quantitatively explained on the assumption of resonance in ^{25}Mg. N. M. B.

Search for a neutron-deuteron reaction. L. B. Borst and W. D. Harkins (Physical Rev., 1940, [ii], **57**, 659).—An attempt was made to prepare ^3H by bombardment of D_2O with neutrons slowed in paraffin followed by electrolysis of the D_2O and counter measurements for radioactive ^3H. Results were negative. Measurements under identical bombarding conditions of activities in Al and Ag gave a ^{28}Al activity indicating a capture cross-section of ^{27}Al for slow neutrons 300 times that of ^2D. The $^{109}Ag/^2D$ capture cross-section ratio was 10^4. The estimated cross-section of the reaction $^2D + {}^1n = {}^3H$ is 2—3 × 10^{-28} sq. cm. N. M. B.

Nuclear cross-sections for neutrons with 860 ke.v. energy in the region of light elements. T. Goloborodko and A. Leipunski (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 41—43).—Using a monochromatic neutron source of 860 ke.v., the nuclear scattering cross-sections of 16 light elements have been evaluated. W. R. A.

Resonance penetration of α-particles in the aluminium nucleus by a photographic method. O. Merhaut (Z. Physik, 1940, **115**, 77—96).—By means of a special photographic technique the proton yield in relation to the active α-particle energy has been examined for the reaction ${}^{27}_{13}Al + {}^4_2He \rightarrow {}^{*31}_{15}P \rightarrow {}^{30}_{14}Si + {}^1_1H$. L. G. G.

Collisions of α-particles with chlorine nuclei. W. HANSEN and G. A. WRENSHALL (Physical Rev., 1940, [ii], 57, 750).—Using a large-diameter cloud chamber filled with MeCl and He, the cloud tracks of ~700,000 Th-C + C' α-particles were photographed with a stereoscopic camera, and 41 forks ascribed to collisions of α-particles with Cl nuclei are analysed. The range–velocity curve is plotted and discussed. N. M. B.

Isotopic identification of induced radioactivity by bombardment of separated isotopes; 37-minute ^{38}Cl. J. W. KENNEDY and G. T. SEABORG (Physical Rev., 1940, [ii], 57, 843—844).—The Clusius–Dickel thermal diffusion method was applied to HCl and the separated $H^{35}Cl$ fraction was bombarded with neutrons slowed by paraffin in order to establish the assignment of Cl (37 min.) which can be formed by the Cl (n, γ), Cl (d, p), and K (n, α) reactions. Results indicate that the 37-min. activity is due to ^{38}Cl formed by neutron absorption by ^{37}Cl. A 5-Me.v. group of β-particles (cf. Davidson, A., 1940, I, 141) is probably due to ^{38}Cl formed in the reaction ^{40}A (d, α) ^{38}Cl. N. M. B.

Excitation of the 455-ke.v. level of ^{7}Li by proton bombardment. C. M. HUDSON, R. G. HERB, and G. J. PLAIN (Physical Rev., 1940, [ii], 57, 587—592; cf. A., 1937, I, 339).—Records of single and coincidence counts of γ-rays from a thin film of Li bombarded by 0·4—2·08-Me.v. protons show that above 0·85 Me.v. proton energy most of the radiation is due to excitation of the 0·455-Me.v. level of ^{7}Li without permanent capture of the proton (cf. A., 1939, I, 4). Above the 0·440-Me.v. resonance the yield of 17-Me.v. γ-radiation falls to a low approx. const. val. up to 1·6 Me.v. The absorption coeff. in Pb for the soft γ-radiation from Li was compared with that of annihilation radiation from ^{13}N. Assuming 0·511-Me.v. monochromatic radiation from ^{13}N, the energy of the soft Li radiation is 0·459 Me.v., indicating that $\not>$10% as many 0·28-Me.v. quanta as 0·511-Me.v. quanta are present in the radiation from ^{13}N (cf. Richardson, A., 1939, I, 295). N. M. B.

Photographic method of studying β-ray absorption by $^{32}_{15}$P. J. GOVAERTS (Nature, 1940, 145, 624).—A photographic method for determining the intensity of β-rays emitted from an artificial radio-element is described. L. S. T.

Coincidence counting method applied to experiments in nuclear physics. J. V. DUNWORTH (Rev. Sci. Instr., 1940, 11, 167—180).—Details are given of the methods of approaching the problem of nuclear levels and the difficulties involved are discussed. The max. source strength which can be used is inversely ∝ coincidence resolving time, and the coincidence counting method has the advantage that it can be used with very weak sources (~0·00001 millicurie). The abs. net counting efficiency of a Geiger counter for all types of radiation must be known and the method of finding this while obtaining data about nuclear level schemes is described. The coincidence method makes possible a simple and rapid determination of the total energy of disintegration of β-radioactive nuclei and therefore of the mass differences between parent and derived nuclei. T. H. G.

New type of disintegration produced by deuterons. R. S. KRISHNAN and T. E. BANKS (Nature, 1940, 145, 777).—^{62}Cu is formed by bombarding Cu foil with 9-Me.v. deuterons. The threshold for the production of this radio-element is ~7 Me.v., and the yield increases rapidly between 8 and 9 Me.v. In the formation of ^{62}Cu the $(d–p, 2n)$ reaction is more probable than the $(d–d, n)$ reaction. L. S. T.

Existence of the ^{5}He nucleus. P. JENSEN (Z. Physik, 1940, 115, 55—60).—Endeavours to perform the reaction ^{2}H (α, p) ^{5}He have failed. L. G. G.

Cross-section of the reaction ^{15}N (p, α) ^{12}C. M. G. HOLLOWAY and H. A. BETHE (Physical Rev., 1940, [ii], 57, 747; cf. A., 1939, I, 592).—The determination of the cross-section of the reaction, one of the four reactions in the "C cycle" assumed to supply the energy in ordinary stars (cf. A., 1939, I, 237), is described. The val. obtained is $1·3 \times 10^{-26}$ sq. cm. at 0·36 Me.v. proton energy, in satisfactory agreement with the calc. val. $0·9 \times 10^{-26}$ sq. cm. N. M. B.

Radioactivity of the fluorine isotope of mass 20. S. C. CURRAN and J. E. STROTHERS (Proc. Camb. Phil. Soc., 1940, 36, 252—254).—The transition $^{20}F \rightarrow ^{20}Ne$ occurs with emission of a β-particle of max. energy 5·0 Me.v., followed by a γ-quantum of energy 2·2 Me.v. The transition from the excitation level of ^{20}Ne at 2·2 Me.v. can occur in two stages. L. J. J.

Radio-sulphur. H. LEVI (Nature, 1940, 145, 588; cf. A., 1936, 773).—$^{35}_{16}$S has been obtained by the prolonged action of fast neutrons from Ra + Be on CCl_4 or, preferably, NaCl. The half-life period is 88±5 days. Al foil (30 mg. per sq. cm.) reduces the activity by >90%; this gives $1·2—2·0 \times 10^5$ e.v. as the upper limit of the β-rays from S (cf. A., 1939, I, 170). L. S. T.

Radio isotopes of chromium. T. AMAKI, T. IIMORI, and A. SUGIMOTO (Physical Rev., 1940, [ii], 57, 751—752).—Deuteron bombardment of Cr gave isotopes of half-lives 1·6 hr. and ~14 days, probably due to ^{55}Cr and ^{51}Cr, respectively. Slow neutron bombardment induced very weak activities of 2·8, 14, and 1·7 hr., probably due to impurities detected chemically and to an unidentified Cr isotope (1·7 hr.). Fast neutron bombardment induced weak activities: 3—4 hr., probably ^{50}V (3·7 hr.) produced by ^{50}Cr (n, p) ^{50}V; 14 hr., probably ^{24}Na from Al impurity as by slow neutrons; and 12 days, probably ^{51}Cr (~14 days) as by deuteron bombardment. N. M. B.

Threshold value for nuclear excitation of *^{115}In by X-rays. M. I. KORSUNSKI, F. F. LANGE, and V. S. SCHPINEL (Compt. rend. Acad. Sci. U.R.S.S., 1940, 26, 144).—Counter measurements show that the threshold val. for excitation of *^{115}In by X-rays is <1350 kv., and probably ~1000 kv. L. J. J.

Fission of separated uranium isotopes. (A) A. O. NIER, E. T. BOOTH, J. R. DUNNING, and A. V. GROSSE. (B) K. H. KINGDON, H. C. POLLOCK, E. T. BOOTH, and J. R. DUNNING (Physical Rev.,

1940, [ii], **57**, 748, 749).—(A) From slow neutron tests of larger samples of partly separated ^{235}U and ^{234}U, the observed fissions per min. and α-particles per min. conclusively confirm previous results (cf. A., 1940, I, 187) that ^{235}U is responsible for at least 75% of slow neutron fission in unseparated U. ^{234}U is present only to 1 part in 17,000 but may contribute slightly. Fast neutron tests on ^{238}U show that it undergoes fast neutron fission only, and can account for practically all the fast neutron fission observed from unseparated U.

(B) From UCl_4 vaporised in a furnace, samples of ^{238}U and $^{234+235}U$ were prepared with a mass spectrograph. Fission tests of the separated isotopes by slow neutron bombardment show conclusively that ^{238}U is not responsible for slow neutron fission.

N. M. B.

Radioactive zirconium and niobium from uranium fission. A. V. Grosse and E. T. Booth (Physical Rev., 1940, [ii], **57**, 664—665).—Irradiation for several days of U nitrate by slow neutrons from a cyclotron gave a product from which Zr was separated, and from this a previously unknown Nb isotope was observed to grow. Decay curves give respective half-lives of 17·0±0·2 hr. and 75±3 min. Both emit β-rays of max. energy ~1 Me.v. There is evidence of a longer-life Zr (>20 days) emitting low-energy electrons (~0·25 Me.v.). N. M. B.

New radioactive isotope of masurium, $^{101}_{43}$Ma. R. Sagane, S. Kojima, G. Miyamoto, and M. Ikawa (Physical Rev., 1940, [ii], **57**, 750).—Decay curves of the chemically separated Ma and Mo fractions of Mo after bombardment with slow neutrons show a new isotope ^{101}Ma (9±1 min. emitting 1·14-Me.v. β-rays) derived from ^{101}Mo (19±1 min. emitting 1·78-Me.v. β-rays). N. M. B.

Isomeric silver and the Weizsäcker theory. L. W. Alvarez, A. C. Helmholz, and E. Nelson (Physical Rev., 1940, [ii], **57**, 660—661).—A study of 6·7-hr. Cd formed in the reaction Ag (*d*, 2*n*) Cd shows an anomalously high ratio of *L*- to *K*-conversion electrons of a 93·5-ke.v. γ-ray which are found to come from an excited state of stable Ag (40±2 sec.); this is accompanied by a weak γ-ray of ~90 ke.v. and is probably the unconverted fraction of the 93·5-ke.v. γ-ray (cf. Delsasso, A., 1939, I, 173). The *K–L* conversion ratio requires a multipole order of 4±0·1 for the transition between the two Ag states; the measured internal conversion coeff. of 98% requires a similar val. On this assumption the life-time of a 93·5-ke.v. level in Ag, calc. by Weizsäcker's corr. formulæ, gives the expected val. of 30 sec. The agreement indicates that the transition is an electric rather than a magnetic 2^4 pole, so that the spin difference between the two Ag states is 4 units.

N. M. B.

Soft component of cosmic radiation in connexion with the problem of mesotron disintegration. D. V. Skobeltzyn and S. N. Vernov (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 33—36).—The hypothesis of mesotron disintegration provides no explanation of the intensity of the soft component in the bottom layers of the atm. in terms of the cascade theory. W. R. A.

Number of "decay electrons" accompanying penetrating particles. K. I. Alexeeva (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 28—32).—In travelling from the top of the atm. to sea-level some mesotrons undergo disintegration. The amount of penetrating radiation has been measured in air and after passage through filters of wood. The no. of "decay electrons" has been estimated from these data and the significance of the results is discussed.

W. R. A.

Origin of the hard component of cosmic radiation. M. Schönberg (Ann. Acad. Brasil. Sci., 1940, **12**, 33—34).—From Heitler's views of the origin of cosmic radiation (A., 1938, I, 429) it is predicted that penetrating particles created in the same process will cohere and remain associated over great distances (cf. Bhabha, *ibid.*, 291). F. R. G.

Seasonal and atmospheric temperature effect in cosmic radiation. V. F. Hess (Physical Rev., 1940, [ii], **57**, 781—785; cf. A., 1940, I, 188).—Analysis of cosmic-ray ionisation observations during 5 years at a location 2300 m. above sea-level establishes a seasonal variation with an amplitude of ±0·9%. The temp. coeff. of the cosmic radiation is ~ −0·12 in winter and ~ −0·055% per 1° in summer. Unscreened ionisation chambers and coincidence counters give smaller temp. coeffs. which become positive in summer. Hence the normal negative temp. effect cannot be explained completely on the basis of the mesotron disintegration hypothesis. N. M. B.

Barometric coefficient of extensive cosmic-ray showers. M. G. E. Cosyns (Nature, 1940, **145**, 668).—This coeff. increases rapidly with the diameter of showers up to 20 m. At sea-level above and below a thin tiled roof, an important part of the soft rays associated with 20-m. showers is produced in the roof as ordinary secondary showers. This may explain apparent anomalies in the results of former investigators. L. S. T.

Cosmic-ray intensities and cyclones. Y. Nishina, Y. Sekido, H. Simamura, and H. Arakawa (Nature, 1940, **145**, 703—704).—The effect of cyclones on these intensities has been examined. L. S. T.

Cosmic-ray intensities and air masses. Y. Nishina, Y. Sekido, H. Simamura, and H. Arakawa (Physical Rev., 1940, [ii], **57**, 663).—The possible correlation of cosmic-ray effects with atm. depressions (cf. Blackett, A., 1939, I, 55) is discussed with reference to intensities under typical air mass conditions at Tokyo. N. M. B.

Positive excess and electron component in the cosmic-ray spectrum. D. J. Hughes (Physical Rev., 1940, [ii], **57**, 592—597; cf. Jones, A., 1940, I, 189).—In view of discordant available data on the excess of positive over negative particles in the cosmic-ray spectrum, an investigation of the sea-level spectrum, with and without a Pb filter, was made. Results show, respectively, a ratio of positives to negatives of 1·21 ± 0·08 and 1·18 ± 0·08. Comparison of the two spectra shows the presence of an absorbable component (electrons) in the energy region 2—8 × 10^8 e.v., but no absorbable particles of higher energy. N. M. B.

System of units for nuclear and cosmic-ray phenomena. B. Rossi (Physical Rev., 1940, [ii], **57**, 660).—An attempt to adopt a consistent system of units for nuclear or cosmic-ray phenomena and for macroscopic physics. N. M. B.

Interpretation of neutron measurements in cosmic radiation. H. A. Bethe, S. A. Korff, and G. Placzek (Physical Rev., 1940, [ii], **57**, 573—587).—Study of the factors influencing the energy distribution of neutrons in the atm. shows that diffusion equilibrium exists except for $\sim$1 m. of H_2O at the top and 1 m. above ground. An equation is given for the energy distribution below 100 ke.v., which contains few thermal neutrons. As an example of ground influence, the neutron distribution in the air above a H_2O surface is calc. Experimental arrangements are discussed; a detector such as a BF_3 counter measures essentially the neutron density, and the evaluation of experiments using hydrogenic material to slow down the neutrons is considered. From these two types of experiments concordant results for neutron production are obtained. N. M. B.

Energy loss of electrons in carbon and the decay of the mesotron. H. R. Crane, N. L. Oleson, and K. T. Chao (Physical Rev., 1940, [ii], **57**, 664; cf. Fermi, A., 1940, I, 91).—The energy loss in graphite for 10-Me.v. electrons was measured. The net corr. val. due to collisions alone is 1·69 $\pm$ 0·08 Me.v. per g. per sq. cm. (cf. A., 1937, I, 594). Vals. for the collision loss calc. by the Bloch–Fermi formulæ for the dielectric const. effect are given. The experimental loss val. accords best with ϵ 1·05—1·5. N. M. B.

Average number of electrons accompanying a cosmic-ray meson due to collisions of the meson with atomic electrons. E. J. Williams (Proc. Camb. Phil. Soc., 1940, **36**, 183—192).—The average no. of electrons accompanying a meson, due to collisions with at. electrons, is calc. as 0·36 for air and 0·39 for Pb. The no. of electrons with energy $>$ 3 Me.v. is 0·12—0·16 for air, 0·10—0·15 for Cu, and 0·08—0·13 for Pb, assuming in each case a pure Coulomb interaction. L. J. J.

Shower production by mesotrons in different materials. W. F. G. Swann and W. E. Ramsey (Physical Rev., 1940, [ii], **57**, 749).—Using the arrangement previously described (cf. A., 1939, I, 547), measurements for Pb are extended to Sn, Fe, and Mg. Results are plotted and discussed. N. M. B.

Hypothesis of the existence of contraterrene matter. V. Rojansky (Astrophys. J., 1940, **91**, 257—260).—The existence of atoms ("contraterrene") consisting of negatively charged nuclei surrounded by positrons is discussed. Identification should be possible through annihilation effects resulting from their collisions with ordinary atoms. L. S. T.

Metastability of hydrogen and helium levels. G. Breit and E. Teller (Astrophys. J., 1940, **91**, 215—238). L. S. T.

Theory of nuclear forces. R. Peierls (Nature, 1940, **145**, 687—690).—A summary. L. S. T.

Type of elementary particle for which the wave-functions satisfy the Klein–Gordon equation. A. Proca (Compt. rend., 1940, **210**, 563—564).—Theoretical. A. J. E. W.

Possibility of existence of a second series of "rare earths" in the place reserved for actinium in the periodic table. G. E. Villar (Ann. Acad. Brasil. Sci., 1940, **12**, 51—57).—From the electronic structure of Ac, Th, Pa, and U it is concluded that these, with 11 succeeding trans-U elements, form a group analogous with the rare-earth elements. This view is supported by the supposed properties of the disintegration product of U obtained by Curie and Savitch (A., 1938, I, 291; cf. A., 1939, I, 116). F. R. G.

Mass centre in relativity. M. Born and K. Fuchs (Nature, 1940, **145**, 587).—A relativistic formulation of the theorem of mass centre for free particles is presented. L. S. T.

Mass of the universe. (A) C. M. Beadnell. (B) (Sir) A. S. Eddington (Nature, 1940, **145**, 549). L. S. T.

Binding energy of ^{7}Li. K. G. Carroll (Physical Rev., 1940, [ii], **57**, 791—794).—Mathematical. There is a large discrepancy between the known binding energy and that calc. on a first-order Hartree method with reasonable nuclear consts. It is shown that on including higher orders in the perturbation treatment about half the discrepancy remains and may be attributed to the exchange forces assumed. N. M. B.

Dynamics of complex fission. R. D. Present and J. K. Knipp (Physical Rev., 1940, [ii], **57**, 751).—Mathematical. A preliminary report of an investigation of the large-amplitude distortions of a nucleus undergoing fission. An expression for the potential energy of distortion is given and detailed conclusions are discussed. N. M. B.

Theory of electric charge and the quantum theory. II. H. T. Flint (Phil. Mag., 1940, [vii], **29**, 417—433).—Mathematical. The author's earlier treatment (A., 1938, I, 596) is extended to a five-dimensional continuum. L. J. J.

Classical theory of electrons. H. J. Bhabha (Proc. Indian Acad. Sci., 1939, **10, A**, 324—332).—Theoretical. W. R. A.

Hydrodynamics of an electronic gas. D. I. Blochintzev (Mém. Physique, Kiev, 1940, **8**, 143—147).—Mathematical. R. T.

Degeneracy in quantum mechanics. J. M. Jauch and E. L. Hill (Physical Rev., 1940, [ii], **57**, 641—645).—Mathematical. N. M. B.

Connexion between the spin and statistics of elementary particles. J. S. de Wet (Physical Rev., 1940, [ii], **57**, 646—652).—Mathematical. N. M. B.

Generalised wave equation and classical mesodynamics. D. Ivanenko and A. Sokolov (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 37—40).—Mathematical. W. R. A.

Structure of the OD bands of heavy water. K. R. RAO and M. G. SASTRY (Nature, 1940, **145**, 778).—The bands at 2872 and 2916 A. have been measured using discharges through the vapour of 99·6% D_2O. They correspond with the (1, 0) and (2, 1) bands of OH with heads at 2811 and 2875 A. due to $^2\Sigma^+ \rightarrow {}^2\Pi_{\text{inv.}}$. The consts. for the 2872 A. band are recorded. L. S. T.

Dissociation schemes for diatomic hydrides and deuterides. II. L. GERÖ and R. SCHMID (Z. Physik, 1940, **115**, 47—54; cf. A., 1939, I, 183).—Theoretical. L. G. G.

Tail bands of the Deslandres–d'Azambuja system of the C_2 molecule. G. HERZBERG and R. B. SUTTON (Canad. J. Res., 1940, **18**, **A**, 74—82).—The investigation of the C_2 spectrum has been continued (cf. A., 1937, I, 595). Analysis of new bands shows that they are tail bands of the Deslandres–d'Azambuja system. Improved vals. for the rotational and vibrational consts. of the upper and lower states $^1\Pi_g$ and $^1\Pi_u$ have been obtained. The energy difference between the $^1\Pi_u$ state and the $^3\Pi_u$ ground state is 1·7 e.v., in fair agreement with Mulliken's theoretical estimate of 2·1 e.v. C. R. H.

Negative bands of the heavy nitrogen molecules. R. W. WOOD and G. H. DIEKE (J. Chem. Physics, 1940, **8**, 351—361).—A detailed account of work already noted (A., 1939, I, 1, 49). It is confirmed that the spin of ^{15}N is $\frac{1}{2}$. W. R. A.

Rotational analysis of the band spectrum of boron monobromide. E. MIESCHER and E. ROSENTHALER (Nature, 1940, **145**, 624).—Consts. for the BBr mol. are given. L. S. T.

Spectroscopic evidence for the B_2 molecule. A. E. DOUGLAS and G. HERZBERG (Physical Rev., 1940, [ii], **57**, 752).—An attempt to observe a B_2 spectrum in a discharge through He at ~10 mm. pressure containing a trace of BCl_3 shows a system of new bands at 3300—3170 A. having a simple fine structure (*P* and *R* branches only). The emitter is shown to be the B_2 mol. and its existence is established for the first time. The main bands are due to $^{11}B^{11}B$ and the weaker bands to $^{11}B^{10}B$. A preliminary vibrational analysis yields an expression for the band heads; consts. are found from rotational analysis and give internuclear distances 1·628 and 1·595 A. for r_0' and r_0''. The spin of the ^{11}B nucleus is probably 3/2. The bands probably represent a $^3\Sigma_u^- \rightarrow {}^3\Sigma_g^-$ transition. When N_2 was added to the discharge new band systems around 3600 and 3225 A. were found, the former due definitely, and the latter probably, to BN. When H_2 was added two new electronic transitions of BH were found at 3415 and 3100 A. N. M. B.

Absorption variations of a selenium-tinted glass as a function of temperature. J. ESCHER-DESRIVIÈRES and Y. GODRON (Compt. rend., 1940, **210**, 215—217).—Transmission curves (5700—6600 A.) for orange-red Se-tinted glasses at 10—360° are given. Increase of temp. from 10° to 100° and 300° displaces the curves 100 and 400 A., respectively, towards higher λλ. The curves are approx. parallel at 10—150°, but become deformed at higher temp., with loss of transparency. The absorption changes appreciably over the normal range of room temp. A. J. E. W.

Band spectrum of SnTe in emission. R. F. BARROW (Proc. Physical Soc., 1940, **52**, 380—387; cf. A., 1939, I, 178).—Using a heavy-current uncondensed discharge through a mixture of Sn, Te, and Al in a Si discharge tube, the band spectrum of SnTe was photographed in emission. In the region λλ 3575—4235 ~45 bands were observed and measured, and 26 of these are assigned to a main system for the band heads of which an equation is found. Bands on the short-λ side of the system appear to belong to an incompletely developed system. Heads increasingly distant from their respective system-origins become increasingly diffuse owing to the vibrational isotope effect. Available results for the analogous PbO, SnO, PbSe, PbTe, SnSe, SnS, and PbS are reviewed (cf. Walker, A., 1938, I, 116). N. M. B.

Band spectrum of antimony chloride. W. F. C. FERGUSON and I. HUDES (Physical Rev., 1940, [ii], **57**, 705—707; cf. A., 1938, I, 116).—A band spectrum in the region λλ 4200—5600, attributed to SbCl, was excited by introducing $SbCl_3$ into active N, and consists of bands showing marked progressions and degraded towards the red. They are classified into two sub-systems and vibrational analysis gives expressions for the wave nos. of the heads of 41 bands. The Cl isotope effect appears in 13 bands. Introduction of $AsCl_3$ vapour into active N failed to produce a spectrum of AsCl. N. M. B.

Spectra of lead hydride and tin hydride in the near infra-red. W. W. WATSON and R. SIMON (Physical Rev., 1940, [ii], **57**, 708—709; cf. A., 1939, I, 118).—Corr. PbH band origins and assignments of the lines of 4 additional bands in the photographic infra-red to 9105 A. are tabulated, and from analyses of these bands revised calculations of energy consts. are obtained. An isolated weak PbH band is found at 3815 A. Additional SnH bands in the red produced in the high-pressure arc are briefly discussed (cf. *ibid.*, 238). N. M. B.

Interpretation of the long-wave infra-red emission (300 μ.) of the mercury high-pressure arc as temperature radiation. W. DAHLKE (Z. Physik, 1940, **115**, 1—10; cf. A., 1940, I, 50).—Continuation of earlier work. An equation is developed for the intensity of emission. L. G. G.

Atmospheric absorption of infra-red solar radiation at the Lowell observatory. II. Spectral interval 5·5—8 μ. A. ADEL and C. O. LAMPLAND (Astrophys. J., 1940, **91**, 1—7; cf. A., 1939, I, 239).—The intensity variations in the telluric spectrum between 5·5 and 8 μ. are large; they are regarded empirically as functions of atm. H_2O-vapour content. L. S. T.

Colours of 1332 B stars. J. STEBBINS, C. M. HUFFER, and A. E. WHITFORD (Astrophys. J., 1940, **91**, 20—50).—The colours of 1332 stars of spectral types B, O, cB, and cA, measured with a photoelectric cell, are tabulated. L. S. T.

***CH* bands in comet spectra.** J. DUFAY (Astrophys. J., 1940, **91**, 91—102).—The presence of the 4300 A. band, and probably that of the 3900 A. band, is confirmed. L. S. T.

Spectral energy curve of the sun in the ultra-violet. E. PETTIT (Astrophys. J., 1940, **91**, 159—185).—The O_3 content of the atm. above Mt. Wilson is $\sim$0·1 cm. $\lambda\lambda$ and line intensities in the ultra-violet O_3 band are recorded; the line intensities are too low to be distinguishable in the solar spectrum. L. S. T.

Infra-red spectra and the structure of molecules. W. H. J. CHILDS and H. A. JAHN (Nature, 1940, **145**, 646—649).—A review. L. S. T.

Infra-red absorption. X. Infra-red absorption of hydrogen fluoride in the vapour state and in solution in an inert solvent. A. M. BUSWELL, R. L. MAYCOCK, and W. H. RODEBUSH (J. Chem. Physics, 1940, **8**, 362—365).—In agreement with the data of Imes (cf. A., 1921, ii, 4), HF in the vapour state exhibits two bands with centres at 2·59 and 2·47 μ. due to single mols., and stronger absorption at 2·85 and 2·97 μ. due to H-bonded polymerides. In CCl_4 (0·0045—0·016 mol. HF per l.) very little absorption due to association is encountered and this is difficult to explain. The spectrum of a thin crystal of KHF_2 is recorded and discussed. W. R. A.

Vibration spectra of azoimide, methyl azide, and methyl *iso*cyanate. Thermodynamic functions of azoimide. E. H. EYSTER and R. H. GILLETTE (J. Chem. Physics, 1940, **8**, 369—377).—The infra-red spectra of gaseous HN_3, MeN_3, and MeNCO between 2 and 20 μ. have been investigated. Results are compared with existing Raman data and with data for MeNC. Since these mols. are structurally similar the assignment of observed bands to fundamental modes of vibration is possible for all except the Me torsional frequency in Me compounds. From the similarity of the spectra of MeN_3 and MeNCO it is concluded that the $\cdot N_3$ and ·NCO groups are linear and that the Me is attached at an angle to the linear axis of the $\cdot N_3$ or ·NCO. Resonating structures are given and discussed. Vals. of S, C_p, and $-(G^\circ - H^\circ_0)/T$ from 100° to 600° K. have been evaluated from the fundamental $\nu\nu$ and moments of inertia of HN_3 on the basis of a rigid rotator–harmonic oscillator. The standard free energy and equilibrium const. for the reactions $\frac{1}{2}H_2 + \frac{3}{2}N_2 = HN_3$ and $\frac{1}{3}NH_3 + \frac{4}{3}N_2 = HN_3$ are given from 298·1° to 600° K. W. R. A.

Infra-red spectra. Determination of C–H frequencies ($\sim$3000 cm.$^{-1}$) in paraffins and olefines; observations on "polythenes." J. J. FOX and A. E. MARTIN (Proc. Roy. Soc., 1940, **A**, **175**, 208—233).—The absorption spectra of some 20 hydrocarbons have been studied in the region 2·6—3·8 μ. The valency vibrations characteristic of the following mol. groups were investigated: $\geqslant$C–H and $=CH_2$ in unsaturated hydrocarbons; $>CH_2$ group in long-chain paraffins; Me in saturated and unsaturated hydrocarbons; $\geqslant$C–H in saturated hydrocarbons. Two samples of a polythene showed bands characteristic of the Me group, the spectra being similar to those of normal long-chain paraffins. G. D. P.

Chemical elementary processes in light emission of sulphide phosphors. R. SCHENCK (Z. Elektrochem., 1940, **46**, 27—38).—An exhaustive review and discussion of previous work, directed towards the correlation of optical and other physical data with the characteristics of the relevant chemical equilibria. A. J. E. W.

Luminescence spectra of phosphors activated with silver. A. S. TOPORETZ (Mém. Physique, Kiev, 1940, **8**, 161—166).—The luminescence spectra of the phosphors MX–Ag consist of two bands (245—260 and 360—390 mμ.) when M = Na, and one band (275—290 mμ.) when M = K (X = Cl, Br, I). The mechanism of luminescence is discussed. R. T.

Luminescence of pure radium and barium compounds. D. H. KABAKJIAN (Physical Rev., 1940, [ii], **57**, 700—705; cf. A., 1937, I, 220).—Carefully purified $RaBr_2$, $RaCl_2$, $RaSO_4$, $BaBr_2$, $BaCl_2$, and $BaSO_4$ excited by α-, β-, and γ-rays show a faint luminescence at room temp. When heated and then cooled they show, with increase of heat-treatment temp., a continuous increase in luminescence to a max. Heat-treatment at higher temp. diminishes the brightness. The temp. of max. brightness (which may be several hundred times the initial brightness before heating) is not directly related to m.p. The removal of the second H_2O in $BaBr_2,2H_2O$, by heating at 150—200°, caused a decrease in luminescence followed by a sharp rise. No abrupt intensity changes, such as might be due to changes in cryst. form, were detected. N. M. B.

Extinction of phosphorescence of acetophenone at the temperature of liquid air. B. A. PIATNITZKI (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 220—221).—The extinction follows the law $I = I_0e^{-\alpha t}$, where t is measured in sec. and the average val. of α is 0·6. L. S. T.

Raman effect and crystal symmetry. B. D. SAKSENA (Proc. Indian Acad. Sci., 1940, **11**, **A**, 229—245).—Selection rules for crystals of different symmetries and the polarisation characteristics of the Raman lines for different crystal orientations are discussed. Results are compared with experimental data on $NaNO_3$. W. R. A.

Hindered rotation. I. Configuration of the *cyclo*hexane molecule. A. LANGSETH and B. BAK. **II. Hindered rotation about the C–C single bond in tetrachloroethane.** A. LANGSETH and H. J. BERNSTEIN. **III. Qualitative nature of the interactions hindering internal rotation.** A. LANGSETH, H. J. BERNSTEIN, and B. BAK (J. Chem. Physics, 1940, **8**, 403—409, 410—415, 415—418).—I. Raman spectra of the *cyclo*hexanes, C_6H_{12}, $C_6H_{11}D$, and C_6D_{12} have been examined and intensities and state of polarisation of the lines are given. $C_6H_{11}D$ was prepared from bromo*cyclo*hexane by a Grignard reaction under controlled conditions which prevented formation of *cyclo*-hexane and -hexene. C_6D_{12}, b.p. 77·8—78·0°/760 mm., was prepared by deuterating C_6D_6 with D_2 at 180° in the presence of a Ni catalyst and treating the equilibrium mixture with Br and Fe powder in the dark; C_6D_6 is rapidly brominated but C_6D_{12} is scarcely attacked. The possible models,

D_{6h}, D_{3d}, D_2, C_{2v}, and C_2. and their spectroscopic characteristics and selection rules are discussed. The observed spectrum of C_6D_{12} supports the D_{6h} model, and so do the vals. of the ratio of isotopic frequencies calc. from Teller's product rule. The symmetry of $C_6H_{11}D$ is C_s. Observed νν (<1500 cm.$^{-1}$) have been assigned. There is no evidence of a ^{13}C isotope line; a reason for this is given. The influence of restricted free rotation about the C–C linking on the stability of the mol. is discussed, and it is shown that restricted rotation stabilises the D_{6h} configuration in which the H atoms are in "opposed" positions.

II. Owing to restricted free rotation $(CHCl_2)_2$ might consist of rotational isomerides having a *cis*-form (C_{2v}), a *trans*-form (C_{2h}), or intermediate forms with C_2 symmetry. The potential energy curves are discussed. The Raman frequencies, and their intensities, have been measured at various temp. for $C_2H_2Cl_4$ and $C_2D_2Cl_4$, which was prepared by bubbling C_2D_2 and Cl_2 into a flask containing CCl_4 and finely divided $AlCl_3$. $(CHCl_2)_2$ is an equilibrium mixture of the *cis*- (C_{2v}) -form and a C_2 form, the potential energy of which is 1100 g.-cal. per mol. > that of the more stable C_{2v} form. There appears, therefore, to be an interaction, acting in the opposite sense to dipole interaction, and ensuring that atoms on the two C atoms are in "opposed" positions.

III. From the above work the most stable configurations are those in which the atoms are in "opposed" positions. The most important contributions to potential barriers restricting free rotation are (i) dipole and steric effects which stabilise "staggered" forms and (ii) interactions stabilising "opposed" forms. A physical picture based on the symmetry properties of the mol. and ideas associated with overlapping of wave functions is presented to account for the interactions acting through the C–C linking and tending to stabilise "opposed" configurations. C_2H_6, $(CMe\colon)_2$, C_3H_6, PhMe, $C_2H_4Cl_2$, $C_2H_4Br_2$, and $(CHCl)_2$ are discussed. W. R. A.

Hindered rotation in $CH_2D{\cdot}CH_2Br$. A. LANGSETH, H. J. BERNSTEIN, and B. BAK (J. Chem. Physics, 1940, **8**, 430—431; cf. preceding abstract).—$CH_2D{\cdot}CH_2Br$ can be predicted to be an equilibrium mixture of two rotational isomerides, a *cis*-form in which D is opposed to Br, and two spectroscopically identical *trans*-forms in which D opposes either of the H in $\cdot CH_2Br$. The intensity ratio of Raman lines of the *trans*- and *cis*-forms should $\simeq$ 2. A symmetrical vibration in a *cis*-form is shown to have a lower frequency than the corresponding vibration in a *trans*-form. Thus the Raman spectrum of $CH_2D{\cdot}CH_2Br$ should consist of pairs of lines in which, for symmetrical vibrations, the higher frequency member should be approx. twice as intense as the lower frequency member. The spectra of EtBr and C_2H_4DBr (for the C–Br stretching vibration) are compared, and data agree with theoretical predictions. The D_{3h} configuration of C_2H_6 is substantiated. W. R. A.

Raman spectra of phosphorus methyl and arsenic methyl and the force constant of the methyl compounds of the fifth group elements. E. J. ROSENBAUM, (MISS) D. J. RUBIN, and C. R. SANDBERG (J. Chem. Physics, 1940, **8**, 366—368).—PMe_3 and $AsMe_3$ give 15 and 12 Raman lines respectively. Spectra of XMe_3 mols. (X = N, P, As, Sb, Bi) are compared. The appearance of only two very strong low-frequency lines in $SbMe_3$ and $BiMe_3$ is attributed to an accidental degeneracy produced by the relatively high at. wt. of the apical atom of the pyramidal (C_{3v}) structure and to the val. of the apical angle. Using a two-const. valency force potential function νν and force consts. have been evaluated. Calc. νν are in good agreement with observed vals. Discrepancies between the data obtained for $AsMe_3$ and those given by Feher and Kolb (A., 1940, I, 57) are briefly discussed. W. R. A.

Raman spectrum of glycerol. B. D. SAKSENA (Proc. Indian Acad. Sci., 1939, **10**, **A**, 333—340).—By an improved distillation method glycerol, relatively free from fluorescence, has been obtained and gives 21 Raman displacements and an O–H band. Twelve lines are polarised and 3 depolarised. Assignments of the lines to groups in the mol. are made. The changes in position and intensity of the lines on dilution with H_2O are discussed. W. R. A.

Raman spectra of some carboxylic acids. K. S. BAI (Proc. Indian Acad. Sci., 1940, **11**, **A**, 212—228).—Raman spectra of $Pr^{\beta}CO_2H$ (I) at 35° and 145°, BzOH (II) (molten and solid), lactic acid (III) (liquid), Et lactate (liquid), and cinnamic acid (IV) (molten and solid) are recorded and compared with existing data. For (I) a displacement of 1650 cm.$^{-1}$, found alone at 35°, remains unaltered at 145° and a new displacement of ~1720 cm.$^{-1}$ appears. The smaller displacement is attributed to the C:O group in the dimeride and the larger to the C:O in the monomeride. On this basis it is concluded that (II) and (IV) as solids are principally in the dimeric state but that on melting some monomerides are formed. (III) is almost completely monomeric. The C:O frequency in solid (II) and (IV) is < that in the molten acids, indicating stronger H-bonding. Increased temp. causes ionisation as well as depolymerisation of (I) and this is indicated by the increased intensity of the displacements 790, 1361, and 1532 cm.$^{-1}$ Changes in the location and intensities of lines of (IV) are attributed to *cis–trans* isomerism; (IV) in the solid state is predominantly *trans* but almost completely *cis* in the liquid state. W. R. A.

Mean life of electronically activated nitrogen. R. AUDUBERT and C. RACZ (Compt. rend., 1940, **210**, 217—219).—Photon counter measurements during intermittent electrolysis of 0·5N-NaN_3, synchronised with the rotation of a sector between counter and anode, show that metastable mols. with a mean life of $2{\cdot}5 \pm 0{\cdot}2 \times 10^{-3}$ sec., probably of electronically activated N_2, are formed during the electrolysis. A. J. E. W.

Dielectric constants of some oxides, hydroxides, and oxide hydrates. O. GLEMSER (Z. Elektrochem., 1939, **45**, 865—870).—ϵ obtained by an immersion method is given for hydroxides of Al, Be, Mg, and Zn, various preps. of their oxides, and related minerals. Synthetic, finely-divided products have much higher ϵ than corresponding minerals,

owing to greater mobility of the at. groups, and a correspondingly greater displacement polarisation. Curves relating ϵ to the temp. of dehydration ($\theta \not> 1300°$) are also given for amorphous hydrated Fe_2O_3 and α- and γ-FeO_2H; an abnormal rise in ϵ, commencing at high and variable θ vals., is attributed to formation of Fe_3O_4. A. J. E. W.

Dielectric constant, power factor, and resistivity of marble. A. H. Scott (J. Res. Nat. Bur. Stand., 1940, **24**, 235—240).—The dielectric const. (ϵ) and power factor (f) at 1000 cycles per sec. and the sp. resistance (r) of various samples of marble, dry, and after 30 days' exposure to air of 85% R.H., have been determined. ϵ and f have also been determined for certain marbles at various frequencies. Coloured marbles have higher ϵ and f than white marbles, but r and effects of H_2O are variable. Even for dry marble ϵ varies widely for different samples; a mean val. is 9. J. W. S.

Dielectric polarisation in solution. I. Failure of the Clausius–Mosotti equation. W. H. Rodebush and C. R. Eddy (J. Chem. Physics, 1940, **8**, 424—428).—Whilst infra-red absorption spectra show the presence of H bonds, dielectric polarisation appears to give the most exact information regarding the degree of polymerisation and its variation with concn. Measurement of the dielectric polarisation of alcohols in non-polar solvents has yielded data which cannot be interpreted by the Debye–Clausius–Mosotti (D–C–M) method, particularly in dil. solutions. Consideration of existing data for solutions of non-associated polar solutes in non-polar solvents gives erroneous and misleading conclusions regarding the polarisation of the solute. The main defect of the D–C–M method is that it assumes that the permanent moment is a const. of the mol. irrespective of environment. The Clausius–Mosotti theory appears to contain two fundamental errors, (i) assumption of an unvarying permanent μ, (ii) the inclusion of the reaction field in the total orienting field acting on the mol. These two effects cause deviations in opposite directions. The modifications of Onsager (A., 1936, 1182) are discussed and the limitations of his theory are indicated. A term, called the apparent molal polarisability, $(\epsilon - 1)V/4\pi$, is evaluated for several mols. and is a linear function of concn. The slope of this plot gives the partial molal polarisation which becomes a significant quantity by Onsager's theory. By means of this theory good agreement between observed and calc. vals for solutions is obtained, and it is possible to calculate the moment in the vapour state. When agreement is obtained using D–C–M methods it is considered to be fortuitous. W. R. A.

Behaviour of polar molecules in solid paraffin wax. D. R. Pelmore and E. L. Simons (Proc. Roy. Soc., 1940, **A**, **175**, 253—254; cf. A., 1939, I, 181).—The relaxation time of amyl stearate embedded in paraffin wax was investigated under the conditions previously used for a series of esters with an even no. of C atoms. The results indicate that there is no marked difference between the behaviour of an odd ester and that of its two even neighbours. G. D. P.

Present state of valency theory. L. E. Sutton (J.C.S., 1940, 544—553).—A lecture. F. J. G.

Crystal chemistry of intermetallic compounds of the AB_2 type (Laves phases). G. E. R. Schulze (Z. Elektrochem., 1939, **45**, 849—865).—The three structures (typified by $MgCu_2$, $MgZn_2$, and $MgNi_2$) which occur in Laves phases are "homo-otectic," *i.e.*, they involve exactly similar co-ordination relationships, but differ in symmetry. Their lattices may be regarded as interlaced structures of the component A and B lattices. The A atoms have a physically active co-ordination no. of 16, although each A has only 12 immediate neighbours; the B atoms are 6-co-ordinate. The ideal radius quotient, $A : B$, is 1·225 (observed vals., 1·11—1·38). The interat. distances are slightly < those in pure A and B. The B atoms are slightly deformed, and the B–B linkings are stronger than the A–A linkings; the B lattice in AB_2 has also a higher binding energy than in pure B, owing to the participation of electrons in the penultimate shell. In general, a Laves phase occurs when A has a strong tendency to form metallic linkings with B, and B has an incomplete penultimate electron shell and a radius ~20% < that of A. Other lattice types formed by similar mechanisms are unknown. The application of the results to ternary Laves phases is briefly discussed. A. J. E. W.

Simple method for calculating moments of inertia. J. O. Hirschfelder (J. Chem. Physics, 1940, **8**, 431).—A utilisation of Crawford's method of calculating generalised moments of inertia (A., 1940, I, 198). W. R. A.

Calculations on the energies of hydrocarbons. G. J. Kynch, E. H. Lloyd, and W. G. Penney (Nature, 1940, **145**, 777—778).—New calculations on the energies, internuclear distances, and vibration frequencies of C_6H_6 and butadiene mols. are recorded in both the ground and excited states. The heat of sublimation computed for C is 170±10 kg.-cal. per g.-mol. L. S. T.

Energy in unsaturated hydrocarbon molecules. C. A. Coulson (Proc. Camb. Phil. Soc., 1940, **36**, 201—203).—Mathematical. The mol. orbital method is applied to the calculation of the energy of the mobile electrons in unsaturated hydrocarbon mols. L. J. J.

Molecular orbitals. C. A. Coulson and G. S. Rushbrooke (Proc. Camb. Phil. Soc., 1940, **36**, 193—200).—Conditions under which the mol. orbital method gives a self-consistent field in the case of mobile electrons in unsaturated hydrocarbon mols. are analysed. L. J. J.

Bonding powers of groups of *d* electrons. W. G. Penney (Trans. Faraday Soc., 1940, **36**, 627—633).—The binding energies (W) of hydrated ions to their H_2O clusters, when plotted against at. no., fall on a smooth curve for $Ca^{••}$, $Mn^{••}$, and $Zn^{••}$, whilst for ions of intermediate at. no. they do not. A theory is outlined which, by taking account of differences in the energies of the most stable orientations of groups of electrons d^0—d^{10} and using these to correct the vals. of W, enables the intermediate ions to be brought more into line with $Ca^{••}$, $Mn^{••}$, and $Zn^{••}$. It also

permits an approx. estimate of the heats of vaporisation of the metals. F. L. U.

Electronic absorption spectra in solution with special reference to the continuous absorption of the halogens. N. S. BAYLISS and A. L. G. REES (J. Chem. Physics, 1940, **8**, 377—381).—On the basis of the cage theory of liquids the potential function which must be added to the $U(r)$ curves of gaseous mols. to give the $U(r)$ curves of dissolved mols. has been determined. The slight displacement of the absorption max. in halogens dissolved in non-associated solvents and the change in symmetry of the absorption curve are explained. In associated solvents the max. is greatly displaced due to compression of solute mols. by the quasi-cryst. structure of the solvent. The conditions under which band absorption persists in solution are discussed in terms of relaxation time and r_e vals. of normal and excited states. W. R. A.

Electronic absorption spectra in solution. A. L. G. REES (J. Chem. Physics, 1940, **8**, 429—430; cf. preceding abstract).—The addition of a potential barrier to the $U(r)$ curves of the ground and excited electronic levels is proposed to explain solvent effects on absorption spectra. The part of the function which is determined by the cage of solvent mols. about the absorbing mol. can be evaluated from the work necessary to increase the internal surface area of the solvent cage so that the mol. may be accommodated when nuclear separation is increased during a vibration. Br in $CHCl_3$ and Br and I in H_2O are considered. W. R. A.

Correlation of upper electronic states of homologous molecules. R. F. BARROW (Trans. Faraday Soc., 1940, **36**, 624—625).—Attention is drawn to the linear relation existing between $(I_1I_2)^{\frac{1}{2}}$ (I = at. ionisation potential) and the electronic energy for the alkali-metal mols.; its significance is briefly discussed. F. L. U.

Intensities in molecular electronic spectra. X. Calculations on mixed-halogen, hydrogen halide, alkyl halide, and hydroxyl spectra. R. S. MULLIKEN (J. Chem. Physics, 1940, **8**, 382—395).—The dipole strengths for certain perpendicular type transitions $N \rightarrow Q$ have been calc. by the *LCAO* and *AO* approximations. For bromides good agreement with experimental vals. is obtained. Iodides give anomalously low strengths for the $N \rightarrow {}^3\Pi_1$ and $N \rightarrow {}^1\Pi$ parts of the intensity and high strength for $N \rightarrow {}^3\Pi_0{}^+$. The comparison between calc. and observed vals. confirms that ultra-violet continua of H and alkyl halides are $N \rightarrow Q$ transitions. The dipole strength of the ${}^2\Sigma \rightarrow {}^2\Pi$ transition in OH has been calc. A general equation for the $N \rightarrow Q$ dipole strength in AX or OH is derived for any degree of ionicity and polarity. Intensity is not very sensitive to polarity. The relationship between the magnitudes of overlapping and dipole strength integrals and (*a*) mol. stability, (*b*) principal valency quantum no., is discussed. The integrals for mols. containing Cl, Br, or I are $\gg$ for those containing F. They are also larger for HX mols. than for X_2 mols. (X = halogen). W. R. A.

Resonance in the chloroacetic acids. H. O. JENKINS (Nature, 1940, **145**, 625).—The inductive effect of the substituted dipoles does not account completely for the increasing vals. of K for $CH_2Cl{\cdot}CO_2H$, $CHCl_2{\cdot}CO_2H$ (I), and $CCl_3{\cdot}CO_2H$ (II). Resonance, which stabilises preferentially the ionic forms, is suggested as the factor strongly enhancing the K of (I) and (II). Four and twelve conjugated structures contribute to the actual state of the ion in (I) and (II), respectively. A linear relation exists between log K and log n for the three acids with n = 2, 6, and 14, respectively. L. S. T.

Theory of vibrations of sodium chloride lattice. E. W. KELLERMANN (Phil. Trans., 1940, **238**, 513—548).—Ewald's treatment applied to the Born frequency equation for vibrating polar crystals enables a quickly convergent form of the consts. of the equation to be given. The general formulæ for the coeffs. have been worked out and applied to the case of NaCl. The frequencies of vibration of the NaCl lattice have been evaluated for 48 different states of vibration. The frequencies of the residual rays can be found only by taking account of the electrodynamic boundary conditions. The elastic consts. of NaCl have also been evaluated from the coeffs. A. J. M.

Relationship between the critical temperature, b.p., and the parachor values of simple molecules. D. T. LEWIS (Nature, 1940, **145**, 551—552; cf. A., 1938, I, 438).—The major part of the cohesive effect between neutral mols. is exerted probably by electrons not participating in true valency linking. For inert gases, halogen acids, and halogens, the ratio of the coeff. of $[P]$ to this no. of electrons is const. A similar regularity exists when b.p.–$[P]$ equations for a series are considered. L. S. T.

Diffuse scattering of X-rays by crystals. W. H. ZACHARIASEN (Physical Rev., 1940, [ii], **57**, 597—602).—Mathematical. A new derivation of the intensity expression for the coherent scattering of *X*-rays by a small crystal is made. The Debye formula for the diffuse scattering is shown to be incorrect and is replaced by a more complex expression according to which the intensity varies much more rapidly with the scattering direction and shows a series of diffraction max. The consequences of the theory are discussed in detail. N. M. B.

New diffraction maxima in X-ray photographs. S. SIEGEL and W. H. ZACHARIASEN (Physical Rev., 1940, [ii], **57**, 795—797).—A new intensity expression for diffuse scattering of *X*-rays by crystals predicts a rapid variation of intensity with scattering angle. New diffraction max. were observed with a rock-salt crystal and Cu $K\alpha$ radiation, and variations of peak intensities and half-widths with direction of incidence were in general agreement with the theory (cf. preceding abstract). N. M. B.

Mosaic structure of metal crystals. M. ŚMIAŁOWSKI (Wiadom. Inst. Met., 1936, **3**, 212—215; Chem. Zentr., 1937, i, 3603).—The mosaic structure of Zn and Cu single crystals depends more on the conditions of solidification than on the orientation of the nucleus. After deep etching with HNO_3 and HCl,

Zn crystals show striations indicating layers as nearly as possible parallel to the basal plane, or a cell structure which is not directly related to the lattice, according as the hexagonal axis is approx. perpendicular or parallel to the direction of retraction of the crystal. The latter type of structure occurs on cube faces of Cu etched with 10% $(NH_4)_2S_2O_8$. The mosaic structure is not destroyed by slight cold-working, recrystallisation, or prolonged heating below the m.p. 99·999% pure Zn shows no marked tendency to give such structures. A. J. E. W.

Directional oxidation of a single crystal of copper by heating in air at reduced pressure. A. T. GWATHMEY and A. F. BENTON (J. Chem. Physics, 1940, 8, 431—432).—A single spherical crystal of Cu was prepared and surfaced. On heating it in air to (i) 1000° at 0·3 mm. Hg, (ii) 580° at 0·3 mm., (iii) 580° at 4 mm., and allowing it to cool, characteristic oxidation patterns were obtained which show that the reactivity of the crystal varies with the crystal plane along which the surface is prepared. The patterns consist of circular striations and ridges in the crystal surface, which became less prominent on heating the crystal in H_2 at atm. pressure and 580°. It is concluded that (a) O_2 must cause a rearrangement of surface atoms and the development of preferred crystal planes at temp. < the m.p. of Cu, (b) the pattern depends on pressure and temp., (c) on reducing the oxidised surface with H_2, the ridges become less prominent, and if the oxidation is slight, the surface recovers its original appearance. W. R. A.

Specular reflexion of X-rays by high-frequency sound waves. (SIR) C. V. RAMAN and P. NILAKANTAN (Nature, 1940, **145**, 667).—The Laue pattern of diamond along a trigonal axis shows additional sharply-defined spots, which are attributed to dynamic stratifications of ρ in the crystal equiv. to stationary waves of high ν (1332 cm.$^{-1}$). L. S. T.

Greatly enlarged X-ray shadow images. F. MALSCH (Naturwiss., 1939, **27**, 854—855).—The principle used by Ardenne (A., 1939, I, 492) has been employed for some time in the detection of flaws in material with a " fine-focus " tube. Images up to a magnification of 10 are still satisfactorily sharp. A. J. M.

Structure of uranium subsulphide and of the subphosphides of iridium and rhodium. M. ZUMBUSCH (Z. anorg. Chem., 1940, **243**, 322—329).—U subsulphide (cf. A., 1940, I, 266) has a face-centred cubic lattice of U atoms, implying a formula U_4S_n. By comparison of vals. of ρ calc. for various vals. of *n* with those found for U–S preps. of varying composition, *n* is found to be 3. The structure is of NaCl type, with Na replaced by U and 3 Cl replaced by 3 S, the fourth Cl position remaining vacant. a = 5·494 A., and the shortest U—S and U—U distances are 2·75 A. and 3·88 A. Ir_2P and Rh_2P have the *anti*-CaF_2 structure with *a* 5·535 and 5·505 A. respectively. The shortest distances are Ir—Ir 2·77, Ir—P 2·40, Rh—Rh 2·75, and Rh—P 2·38 A., giving the at. radii Ir 1·38, Rh 1·37, P (in Ir_2P) 1·02, P (in Rh_2P) 1·01 A. F. J. G.

X-Ray dispersion in copper crystals. E. M. MCNATT (Physical Rev., 1940, [ii], **57**, 621—624; cf. A., 1939, I, 599).—The diffuse scattering of 1·54-A. Cu $K\alpha$ radiation from single crystals of Cu (λ_k = 1·38 A.) was measured for scattering angles 40—120°. At. structure factors calc. by combining results with available average temp.-modified structure factor vals. obtained by the powdered crystal reflexion method are compared with Hartree theoretical at. structure factors and show that the average decrement caused by dispersion is 1·75 against the Hönl val. 2·8 for this ratio of incident to crit. absorption λλ, λ/λ_k = 1·12. N. M. B.

X-Ray study of the porphins. I. WOODWARD (J.C.S., 1940, 601—603).—A preliminary X-ray study of tetrabenzporphin, $C_{36}H_{22}N_4$ (I), and tetrabenzmonazaporphin, $C_{35}H_{21}N_5$ (II), gives for (I), *a* 17·2, *b* 6·61, *c* 12·2 A., β 122·5°, vol. of unit cell 1165 A.^{3}, 532 electrons per unit cell, and for (II), *a* 17·6, *b* 6·61, *c* 12·5 A., β 122·7°, vol. of unit cell 1218 A.^{3}, 532 electrons per unit cell. They belong to the same space-group C_{2h}^5 ($P2_1/a$) as the phthalocyanines, but differ considerably from the latter in cell dimensions and packing of mols. Crystals of (II) show strong magnetic anisotropy, the max. susceptibility being normal to the (20$\bar{1}$) plane. A. J. M.

Scattering of X-radiation by liquid helium II. J. REEKIE (Proc. Camb. Phil. Soc., 1940, **36**, 236—241).—Liquid He II at 1·15° and 2·15° K. gives a typical liquid-ring diffraction pattern, with an intensity max. at ~27·5° deviation for X-radiation of λ 1·54A. L. J. J.

X-Ray study of the primary oxide film on iron. A. A. KOSCHETKOV (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 76—79).—Alternate layers of Fe and Fe oxide were deposited on a cylinder by evaporation of Fe wire in vac. and exposure to air. These layers were removed as a fine powder and examined by X-rays. The lattice const. of the oxide is a = 8·36±0·02 A., which is intermediate between the vals. for Fe_3O_4 (8·38) and γ-Fe_2O_3 (8·32); *a* increases if the sample is heated for a period in vac. A mechanism to explain the oxidation is advanced. W. R. A.

Determination of the Bravais lattice and the space group [of Na_2BeF_4 crystals]. G. S. SHDANOV and N. G. SEVASTIANOV (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 80).—An extension of previous work (A., 1939, I, 306). Since reflexions of types *hkl* and *hol* have no missing spectra, the crystals have the primitive Bravais lattice, space-group D_{2h}^{16}. W. R. A.

Effect of valency electrons and electron cloud distortion on intensities in electron and X-ray scattering. V. A. JOHNSON (Physical Rev., 1940, [ii], **57**, 613—621; cf. A., 1940, I, 287).—The intensity distribution, determined photographically, of electrons scattered by ZnO shows marked anomalies with respect to the intensity distribution of the corresponding X-ray pattern. The observed diffraction pattern intensities are accounted for by assuming a polarisation of the *M* shell of the Zn atom, and this hypothesis is tested by calculating the charge

distribution of the M shell under the effect of the electrostatic fields arising from a partly ionic character of the lattice and its deviation from perfect tetrahedral symmetry. The calc. distortion is too small by a factor 1/160 to account alone for the observed anomalies. The effect due to the valency electrons is considered. N. M. B.

Compton line profiles applied to chemical binding. B. L. Hicks (Physical Rev., 1940, [ii], **57**, 665—666).—The method for obtaining new information on the physical state of the electrons forming bonds in gaseous mols. and solids depends on experimental determination of the Compton line shape by the inelastic scattering of X-rays or electrons for the system considered. The fundamental mathematical assumptions are stated. N. M. B.

Structure and orientation of silver halides. H. Wilman (Proc. Physical Soc., 1940, **52**, 323—347; cf. A., 1939, I, 459).—An electron-diffraction study of the reaction of halogen vapours with the (111)-twinned Ag films prepared by condensation on hot rock-salt cleavage faces, and with similar films reduced to single-crystal structure by heat-treatment, is described. The persistence of the Ag twin spots and lines indicates that both types of diffraction are probably due to twinning alone, and not to the presence of crystal surfaces parallel to octahedral planes. Accurate determinations of lattice consts. give vals. identical with the X-ray val. for normal pure bulk Ag. The Ag halides formed had the normal structures, although the chloride crystals were often, and the cubic iodide crystals always, twinned on (111) planes. N. M. B.

Polish layers on nickel. P. E. Axon (Proc. Physical Soc., 1940, **52**, 312—322).—In view of inconclusive available data on the structure of polish on metals, an etched Ni bullet was fired from a revolver, the rifling ridges creating areas which are subjected to a polishing stroke at great abrasive pressure. A layer is created giving an electron diffraction pattern of diffuse haloes which probably result from a smoothing effect carried out by melting of the projections by heat transferred from the gaseous products of explosion. The depth and chemical composition of the layers are found by removing them by controlled etching and sputtering in an A discharge chamber. N. M. B.

Electron diffraction study of the surfaces of alkali and alkaline-earth metals exposed to air. S. Yamaguchi (Nature, 1940, **145**, 742).—Diffraction patterns show that Li_2O (+ LiOH), $NaHCO_3$ (I), $KHCO_3$ (II), and CaO are formed by exposure of the fresh surfaces of the corresponding metals to air for 5 min. Formation of (II) is faster than that of (I), and the film of CaO is $>$ that of MgO formed on Mg under similar conditions (A., 1940, I, 101). L. S. T.

Investigation of thin films of cellulose derivatives by electron diffraction. J. Kakinoki (Proc. Phys. Math. Soc. Japan, 1939, **21**, 66—74).—In the electron diffraction pattern of cellulose derivatives three haloes are found. It is shown that these are probably due not to imperfections of the crystal lattices, but to the amorphous state of the macro-mols., *i.e.*, the fact that the glucose residues have no definite orientation. A. J. M.

Electron-diffraction study of anodic films [on aluminium, tantalum, and titanium]. R. A. Harrington and H. R. Nelson (Amer. Inst. Min. Met. Eng., 1940, Tech. Publ. 1158, 14 pp.; Met. Tech., 1940, **7**, No. 2).—From the fact that Al anodised at room temp. usually gives diffuse patterns, it is inferred that anodic films formed on Al in a wide variety of electrolytes, *e.g.*, H_2SO_4 and H_3BO_3, are amorphous. Anodic treatment in solutions at higher temp. tends to produce anodic films having less random structure which may possibly be cryst. Heating the anodic film on Al to 650° does not appreciably change its structure, although cryst. oxidation products are formed on unanodised Al at temp. above 300°. Under certain conditions anodic films formed on Ta and Ti are at least partly cryst. and under other conditions they are probably amorphous. Immersion of anodised or unanodised Al in H_2O at temp. above 80° produces a thin film of böhmite (α-Al_2O_3,H_2O). A film produced in this way is transformed into γ'-Al_2O_3 at temp. $\sim$650°. Immersion of Al in boiling chemical solutions gives definitely cryst. forms in contrast to the usual results with anodic treatment. R. B. C.

Intensity distribution in X-ray and electron diffraction patterns. X-Ray atom factors of zinc in zinc oxide and chemical binding. C. H. Ehrhardt and K. Lark-Horovitz (Physical Rev., 1940, [ii], **57**, 603—613; cf. Yearian, A., 1935, 1452).—Electron diffraction patterns of ZnO show intensities deviating markedly from those calc. on the assumption of a spherically symmetrical electron distribution in the atom. For a decision between various possible explanations, X-ray diffraction patterns from a flat sample of ZnO were obtained photographically with monochromatic Cu $K\alpha$ radiation, and the relative intensities measured. It is concluded that the observed intensity anomaly must be due to anomalous F factors in the expression for electron diffraction intensity $(Z - F)^2[(\sin\theta)/\lambda]^{-4}$ rather than to effects of dynamical reflexion neglected in the kinematic theory. (Cf. James and Johnson, A., 1939, I, 513, also 1940, I, 286.) Discrepancies at larger vals. of $(\sin\theta)/\lambda$ are discussed in connexion with temp. and order-disorder effects. N. M. B.

Lattice irregularities and their physico-chemical effects. J. A. Hedvall (Svensk Kem. Tidskr., 1940, **52**, 30—47).—Reversible and irreversible lattice irregularities are discussed. No general treatment of activated lattices is possible. Discontinuities in the properties of lattices around the Curie temp. are discussed. M. H. M. A.

Rochelle salt. (A) Properties. (B) Influence of electrostatic fields on elastic properties. H. Mueller (Physical Rev., 1940, [ii], **57**, 829—839, 842—843).—(A) A qual. explanation of the anomalous properties of Rochelle salt (I) is given by four theories: (*a*) the dipole theory, (*b*) by assuming polymorphic transitions at the Curie points, (*c*) by postulating an anomalous piezoelectric effect, and (*d*) by an interaction theory assuming no structural or fundamental abnormalities, but ascribing the observed anomalies

to an accidental degeneration of the piezoelectric interaction between the elastic deformation and the electric polarisation. A new experiment establishes a polymorphic transition (shown to be a spontaneous elastic deformation) at the upper Curie point. A quant. analysis of the experimental data leads to a new interpretation of the elastic and piezoelectric measurements and shows that (*b*) and (*c*) are not valid for (I), but that (*a*) is satisfied to a limited extent. The observed Curie points of the free crystal result from the lattice–dipole coupling as described by (*d*).

(B) In accordance with deductions based on the new interaction theory, when a const. potential is applied across electrodes attached to the *a* faces of a plate of (I), all resonance and anti-resonance frequencies show the same kind of variations with temp. and potential as shown for the highest resonance frequency. The frequency–temp. curves have a sharp min. at the Curie point (23·7°). The magnitude of the field effect diminishes at lower and higher temp. N. M. B.

Irreversible variation of the electrical resistance and light-reflecting power of antimony, arsenic, tellurium, iron, and silver layers condensed at low temperatures. R. SUHRMANN and W. BERNDT (Z. Physik, 1940, **115**, 17—46). L. G. G.

Electrical resistance of indium and indium alloys. S. VALENTINER (Z. Physik, 1940, **115**, 11—16).—The sp. resistance of In and of In–Pb and In–Sn alloys has been determined at room and liquid air temp. Results confirm that neither alloy system forms a continuous series of mixed crystals. The sp. resistance of In is $0{\cdot}0903 \times 10^{-4}$ Ω. at 20° and $0{\cdot}0207 \times 10^{-4}$ Ω. at −191°. L. G. G.

Isomerism of the Schiff bases benzylidenebenzhydrylamine and benzhydrylidenebenzylamine. R. CANDEL-VILA and R. CANTAREL (Compt. rend., 1940, **210**, 628—630).—Detailed morphological and goniometric data are given. Benzylidenebenzhydrylamine is monoclinic, with $a : b : c = 1{\cdot}9466 : 1 : 2{\cdot}3545$, β 108° 33′; benzhydrylidenebenzylamine is triclinic, with $a : b : c = 0{\cdot}76802 : 1 : 0{\cdot}94398$, α 95° 47′, β 96° 46′, γ 84° 50′. A. J. E. W.

Grüneisen's constant for the incompressible metals. J. C. SLATER (Physical Rev., 1940, [ii], **57**, 744—746).—Determinations of Grüneisen's const. from thermal expansion, compressibility, and sp. heat, and also from compressibility and change of compressibility with pressure, give approx. the same result except for the more incompressible metals. Redetermination of the change of compressibility of Fe with pressure (cf. Bridgman, A., 1940, I, 155) allows a correction of the vals. for other metals (Fe having been used as a standard) and the removal of the discrepancy. N. M. B.

Relation between breaking and melting. (A) R. FÜRTH. (B) M. BORN (Nature, 1940, **145**, 741, 741—742; cf. A., 1939, I, 552).—(A) The tensile strength of an isotropic body at low temp. is equal to $l\rho(1 - 2b)/(3 - 5b)$, where b is Poisson's elastic const., l the heat of melting per unit mass, and ρ the density. Vals. given for Ag, Al, Au, Cu, Fe, Ni, etc. agree with experiment.

(B) A comment on the above. Smekal's view that breaking strength belongs to the structure-sensitive properties of solids must be abandoned. L. S. T.

Stability of crystal lattices. (A) M. BORN. (B) R. D. MISRA (Proc. Camb. Phil. Soc., 1940, **36**, 160—172, 173—182).—(A) Stability conditions for the three monat. cubic lattice types are evaluated on the basis of the method of small vibrations. Only data for the long-wave part of the vibrational spectrum are necessary. The method accounts for the known relative stabilities of the three lattice types.

(B) Stability functions for the three lattice types are calc. numerically. L. J. J.

Plastic deformation and recrystallisation of aluminium single crystals. J. A. COLLINS and C. H. MATHEWSON (Amer. Inst. Min. Met. Eng., 1940, Tech. Publ. 1145, 17 pp.; Met. Tech., 1940, **7**, No. 1).—Strain-annealing experiments are reported on a wide variety of orientations covering nearly the entire range of slip on a single system and corresponding with amounts of shear (ratio of shearing distance to distance between lamellæ) at the conclusion of a test of 0·08—0·57. R. B. C.

Photo-elastic property of rock-salt crystals. Y. KIDANI (Mem. Ryojun Coll. Eng., 1939, **12**, 101—114; cf. A., 1937, I, 449).—The use of a half-shadow plate enables very small phase retardations, such as those produced in the photo-elastic effect of rock-salt with small loads, to be determined. The relative coeff. of photo-elasticity of flint glass is $6{\cdot}2 \times 10^{-6}$ per g. cm. The elastic limit of rock-salt and synthetic NaCl crystals is 18—19 g. per sq. mm. The theory of slipping in ionic crystals is developed. A. J. M.

First Benedicks effect in gas-free mercury, as influenced by the mean temperature. C. BENEDICKS and P. SEDERHOLM (Nature, 1940, **145**, 666).—A correction (A., 1940, I, 138). L. S. T.

Electromagnetic induction in water. H. D. EINHORN (Trans. Roy. Soc. S. Africa, 1940, **28**, 143—160).—The e.m.f. induced in H_2O flowing in a magnetic field is ∝ the speed, the magnetic induction, and approx. ∝ the length of the conducting path. The measurable voltage is diminished by an internal voltage drop. For highest sensitivity electrodes should be small. W. R. A.

Calculation of molecular radius from the molecular volume and velocity of sound. W. SCHAAFFS (Z. Physik, 1940, **115**, 69—76; cf. A., 1940, I, 65).—An improved expression for the mol. radius is derived. L. G. G.

Scattering of light by liquid helium. L. I. SCHIFF (Physical Rev., 1940, [ii], **57**, 844—845; cf. Goldstein, A., 1940, I, 149).—Mathematical. Detailed calculations based on London's theory of liquid He (cf. A., 1939, I, 56), for comparison with experiment, lead to arguments against the theory. N. M. B.

Index of refraction of methane in the infra-red and the dipole moment of the CH bond. R. ROLLEFSON and R. HAVENS (Physical Rev., 1940, [ii], **57**, 710—717; cf. A., 1936, 140).—Measurements of n for 49 different λλ in the infra-red range 1—15 μ. are tabulated and interpreted in terms of the

active infra-red frequencies of CH_4. Estimates of the dipole moment of the CH bond and the rate of change of this moment with C—H distance are obtained. Measurements show that the infra-red bands are 6 times less strong than would be necessary to remove the discrepancy between $n_\infty - 1$ as obtained by extrapolation from refractive indices and $\epsilon - 1$ determined from dielectric const. measurements.
N. M. B.

Optical anisotropy of cellulosic sheets. J. SPENCE (Nature, 1940, **145**, 515; cf. A., 1940, I, 148).—The OH content of the cellulose ester and, to a smaller extent, the solvent content of the sheet affect the orientation of the slow ray in the plane of the stressed sheet. An increase in OH content favours the same direction as that of the stress, whilst the introduction of acyl groups favours the normal direction. Uniaxial cellulose acetate sheets show an approx. linear increase in negative birefringence with a decrease from 44·8 to 27·0% Ac. L. S. T.

Dispersion curves of Jena glass between 400 and 800 mμ. and their representation by the Hartmann interpolation formula. H. SLEVOGT (Z. Instrumkde., 1940, **60**, 37—48).—Vals. of the consts. in the Hartmann formula are tabulated for Jena glasses of the Schott catalogue, and interpolation tables are given for the evaluation of dispersion.
O. D. S.

Specific heat of manganese from 16° to 22° K. R. G. ELSON, H. G. SMITH, and J. O. WILHELM (Canad. J. Res., 1940, **18**, **A**, 83—89).—A calorimeter for routine measurement of sp. heat at liquid H_2 and He temp. is described. The at. heat of Mn from 16° to 22° K. is $0{\cdot}00421T + 464(T/410)^3$.
O. D. S.

B.p. of n-heptane and ββδ-trimethylpentane over the pressure range 100—1500 mm. E. R. SMITH (J. Res. Nat. Bur. Stand., 1940, **24**, 229—234).—The b.p. of these compounds have been determined at various pressures by means of Swietoslawski ebulliometers, using H_2O as reference material. Equations are derived expressing the relationship between v.p. and temp.; the b.p. at 760 mm. are 98·428° and 99·232°, respectively. J. W. S.

B.p. of magnesium and magnesium alloys. A. SCHNEIDER and U. ESCH (Z. Elektrochem., 1939, **45**, 888—893).—If Mg is heated in SO_2, a rapid reaction causing an abrupt rise of temp. sets in at the b.p., owing to the destruction of a protective layer of reaction products on the molten Mg surface and consequent rapid supply of Mg to the vapour phase. This effect is used to determine the b.p. of Mg (1103±5°) and of alloys of Mg with 0—40 at.-% of Ag, Al, Sn, Pb, and Cu. The b.p. elevations show that the melts of these alloys contain $\ngtr$10% of compound mols., MMg_2 (probably none), and may be considered as ideal conc. mixtures in the neighbourhood of the b.p. A. J. E. W.

B.p. of selenium. M. DE SELINCOURT (Proc. Physical Soc., 1940, **52**, 348—352).—A precision determination of the b.p. of Se was made using a Si boiling tube method and varying the pressure from 700 to 800 mm. The val. in terms of the international temp. scale is 684·8±0·1° at 760 mm., with a variation of 1·08° per cm. of Hg. N. M. B.

Angle of repose of snow on solids. R. SCHNURMANN (Nature, 1940, **145**, 553—554).—Data recorded for loose and compressed snow at room temp. on bakelite, glass, ferrotype, and steel show that the angle of repose of compressed snow is < that of loose snow. The porosity of loose snow hinders the establishment of thick film lubrication by the melt.
L. S. T.

Thermal expansion of invar. L. F. BATES and J. C. WESTON (Nature, 1940, **145**, 550—551).—The coeff. of thermal expansion of invar has been determined by measuring the changes in temp. that occur when a rod is suddenly stretched and when it is taken through a hysteresis cycle (cf. A., 1940, I, 152). The val. obtained is $0{\cdot}411 \times 10^{-6}$ per °c.
L. S. T.

Velocity distribution of gaseous molecules. Table for obtaining values of the error function complement. A. H. HEATLEY (Canad. J. Res., 1940, **18**, **B**, 123—127).—Vals. from $x = 0$ to 20 of the function $L(x) = 2xe^{x^2}\int_x^\infty e^{-t^2}dt$, which may be used to obtain the true velocity distribution of gaseous mols. from the distribution obtained by considering motion in two dimensions only, are tabulated. Vals. of Miller and Gordon's function, $F(x)$ (cf. A., 1931, 1368), from $x = 10$ to 20 are tabulated. O. D. S.

Coexistence of liquid and gaseous states of aggregation in the critical temperature region. Ethane. S. G. MASON, S. N. NALDRETT, and O. MAASS (Canad. J. Res., 1940, **18**, **B**, 103—117).—A study has been made of the position and nature of the meniscus and distribution of opalescence in bombs containing C_2H_6 as the crit. temp. is approached. The d–T coexistence curve has the classical parabolic form up to 32·23±0·015°, at which point the curve becomes flat along the d axis. By shaking the bomb the crit. temp. T_s can be found accurately and without ambiguity, and the importance of shaking in assisting the attainment of equilibrium between liquid and gaseous phases is shown. C. R. H.

Coexistence of the liquid and gaseous states of aggregation in the critical temperature region. Ethylene. S. N. NALDRETT and O. MAASS (Canad. J. Res., 1940, **18**, **B**, 118—121).—The technique used in the case of C_2H_6 (cf. preceding abstract) has been followed in studying the crit. behaviour of C_2H_4. $T_s = 9{\cdot}21 \pm 0{\cdot}015°$. The shape of the coexistence curve is the same as that for C_2H_6. The term "crit. dispersion temp." is suggested for T_s. C. R. H.

Fundamental principles of energetics. J. N. BRØNSTED (Phil. Mag., 1940, [vii], **29**, 449—470).—A general system of energetic principles is constructed on the basis of quantity and potential concepts.
L. J. J.

Viscosity and molecular structure. H. MARK and R. SIMHA (Nature, 1940, **145**, 571—573).—A review. L. S. T.

Dependence of viscosity of liquids on constitution. A. H. NISSAN, L. V. W. CLARK, and

A. W. NASH (J. Inst. Petroleum, 1940, **26**, 155—211).—Details are given of results recorded previously (A., 1939, I, 411). It is assumed that the ultimate unit of a liquid flows in a series of jumps, and that the crit. energy (Q) required to permit the particle to jump is given by $\eta = Ae^{Q/RT}$. The view is confirmed by the observation that log η when plotted against $T/T_{b.p.}$ gives a smooth curve (sp. viscosity curve) for 137 liquids. The ratio L/Q (L = mol. latent heat of vaporisation) is a const. characteristic of each liquid, being lowest for metals and highest for simple gases (A, N_2, CO, CH_4). The inclination of the sp. viscosity curve is influenced principally by mol. shape, whilst dipole effects have only a secondary importance.
J. W. S.

Measurement of viscosity in the critical region. Ethylene. S. G. MASON and O. MAASS (Canad. J. Res., 1940, **18**, **B**, 128—137).—A precision oscillating-disc viscometer for use between 0° and 100° and at pressures up to 150 atm. with differential accuracy 1 in 3000, abs. accuracy 1 in 1000, is described. A continuous transition in the viscosity (η) of C_2H_4 occurs along the equilibrium isochore in the crit. region with min. η at 9·9°. The variation of η with density in the crit. region is similar to that observed by Schröer (A., 1935, 925) for Et_2O.
O. D. S.

Thermal diffusion. S. P. FRANKEL (Physical Rev., 1940, [ii], **57**, 661; cf. Furry, A., 1939, I, 395).—Mathematical. A method, based on elementary considerations, of showing the existence and sign of thermal diffusion is described.
N. M. B.

Osmotic diffusion in gases. E. J. HELLUND (Physical Rev., 1940, [ii], **57**, 737—742).—Mathematical. The theory of diffusion induced in a " solvent " gas by the pressure diffusion of two other gases is developed from formulæ previously derived (cf. A., 1940, I, 203). The analysis is applied to the Loschmidt experiment and the pressures generated are found analytically as a function of time elapsed from the onset of diffusion.
N. M. B.

Viscosity-concentration relations. IV. H. L. BREDÉE and J. DE BOOYS (Kolloid-Z., 1940, 39—46).—The two-const. formula proposed earlier (cf. A., 1937, I, 303, 355) has been further applied to colloidal and non-colloidal solutions in H_2O and org. liquids and to emulsions and has been fully confirmed. The relation between the " voluminosity " and the " extension " factors reveals an essential difference between natural (asphaltic bitumens) and synthetic (polymerised ω-hydroxydecoic acid) high polymerides. Papers by Hess and Philippoff (A., 1937, I, 360) and by Sakurada (A., 1938, I, 246) are critically examined.
F. L. U.

(A) Viscosity in the ternary systems: phenol–benzene–aniline, –dimethylaniline, and –diethylaniline. V. V. UDOVENKO and A. P. TOROPOV. **(B) Cryoscopic study of the systems phenol–aniline, –dimethylaniline, and –diethylaniline.** V. V. UDOVENKO and M. I. USANOVITSCH (J. Gen. Chem. Russ., 1940, **10**, 11—16, 17—20).—(A) The η–composition curves suggest formation of PhOH–NH_2Ph, –$NPhMe_2$, and –$NPhEt_2$ compounds; the max. become less well-defined as the [C_6H_6] rises.

(B) The apparent mol. wt. of NH_2Ph and $NPhMe_2$ in C_6H_6 rises with increasing concn.; that of $NPhEt_2$ remains const. In PhOH the apparent mol. wt. falls with rising concn. The mean apparent mol. wt. of mixtures of PhOH and amines in C_6H_6 is > would follow from the additive rule, to a degree increasing with their concn.
R. T.

Azeotropes of 2-methylfuran. A. A. PRIANISCHNIKOV and L. L. GENIN (J. Appl. Chem. Russ., 1940, **13**, 140—141).—The following azeotropic mixtures are described: 2-methylfuran (I)–MeOH, b.p. 51·5—51·6° (MeOH 22·3%), (I)–MeOH–H_2O, b.p. 58·2—58·5°, (I)–$COMe_2$–H_2O, b.p. 55·6°. (I) does not afford azeotropic mixtures with MeOAc, EtCHO, or COMeEt.
R. T.

Velocity and absorption of ultra-acoustic waves in some binary liquid mixtures. I. G. MICHAILOV (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 145—146).—The velocity of ultra-acoustic waves in EtOH–H_2O mixtures has a max. val. at a concn. ~30% EtOH (vol. per vol. of mixture). A decrease in the diffraction of light by the waves is found in the concn. region 30—40%. At 35% concn., no dispersion is found in the frequency range 1·47—5·31 megacycles.
L. J. J.

Dielectric capacity of electrolytes in mixed solvents: ion association in solutions of magnesium sulphate. W. A. MASON and W. J. SHUTT (Proc. Roy. Soc., 1940, **A**, **175**, 234—253).—A method for determining the dielectric const. (ϵ) of a conducting liquid is described. Results are obtained for dioxan–H_2O mixtures and aq. solutions of $CO(NH_2)_2$. ϵ of solutions of $MgSO_4$ in these aq. solvents has been determined. It is concluded that the behaviour of electrolytes in solution can be described by consideration of the simple coulomb forces involved without invoking a sp. influence due to the chemical nature of the solvents.
G. D. P.

Application of Beer's law of absorption to solutions. W. V. BHAGWAT (J. Indian Chem. Soc., 1940, **17**, 53—59).—The applicability of Beer's law to a no. of aq. solutions has been tested. It holds approx. for $K_2Cr_2O_7$, picric acid, $Dy(NO_3)_3$, chromic acid, $Ni(NO_3)_2$, $NiSO_4$, and methylene-blue, but fails for $NiCl_2$, $CoCl_2$, and Me-violet.
F. J. G.

Viscosity of solutions of sodium chromate and of technical chromate solutions. I. G. RISS (J. Appl. Chem. Russ., 1939, **12**, 1787—1789).—η–concn. and η–temp. curves are given for Na_2CrO_4 solutions.
R. T.

Refractometric measurement of free diffusion of soaps in aqueous solution. O. LAMM and H. HÖGBERG (Kolloid-Z., 1940, **91**, 10—19).—The method previously described (cf. A., 1936, 563) has been used to determine diffusion coeffs. (D) of Na octoate, decoate, and dodecoate at 20°. In all three the D–concn. curve presents a region of decreasing D, the upper limit of which is at a concn. which is the lower, the higher is the mol. wt.
F. L. U.

Metallographic study of internal oxidation in α-solid solutions of copper. F. N. RHINES (Amer.

Inst. Min. Met. Eng., 1940, Tech. Publ. 1162, 41 pp.; Met. Tech., 1940, **7**, No. 2).—40 binary Cu α-solid solution alloys were subjected to oxidation in air and in a closed container packed with powdered Cu–Cu_2O. Internal oxidation was found in binary Cu alloys containing Al, Sb, As, Ba, Be, B, Cd, Ca, Ce, Cr, Co, Ga, Ge, In, Fe, Pb, Li, Mg, Mn, Ni, Nb, P, Se, Si, Na, Sr, Ta, Sn, Ti, W, V, Zn, and Zr. External oxidation alone was found in alloys with Ag, Pt, and Pd. The behaviour of alloys containing Bi, S, Te, and Tl was uncertain. The particle size of the pptd. oxides varies with the chemical nature of the alloying element, the concn. of the alloy, and the oxidation temp. Very stable oxides tend to form fine ppts. whilst the less stable ones form coarse ppts. High oxidation temp. and high concns. of the alloying element favour a large particle size. Extensive agglomeration is rarely found. Distribution of the ppt. varies from system to system and is affected by oxidation temp. The rate of growth of the subscale decreases with time, with increasing alloy concn., with fall in temp., and with lowered O_2 pressure. The time to form a given thickness of subscale is almost ∝ the concn. of the alloy. Ternary alloys containing Cu with Sn or Zn and Al, Be, or Si all exhibit double zones of oxidation, the outer band containing the oxides of both metals and the inner band the oxide of only one metal. R. B. C.

Chromium–silicon alloys. N. N. Kurnakov (Compt. rend. Acad. Sci., U.R.S.S., 1940, **26**, 362—364).—Thermal analysis of the system Cr–Si confirms the presence of the compounds CrSi and $CrSi_2$. The hardness of the alloys shows max. at the compositions of these compounds, whilst the sp. vol.–composition curve also shows breaks at these points. J. W. S.

Ferromagnetic anisotropy, magnetisation at saturation, and superstructure in Ni_3Fe and nearby compositions. E. M. Grabbe (Physical Rev., 1940, [ii], **57**, 728—734; cf. A., 1939, I, 247).—Investigation of spheroidal specimens of Fe–Ni alloys (Ni 65—80%) showed that with superlattice formation the anisotropy becomes more like that of pure Ni with (111) as the direction of easiest magnetisation. The change is largest near Ni_3Fe. The saturation magnetisation increases with ordering; the greatest observed increase was 5·8% for an alloy very near Ni_3Fe. Different rates of cooling from the crit. temp. (~490°) affect the saturation magnetisation. The changes are attributed to changes in degree of local ordering effects. Long-distance order, induced by baking for long periods, greatly influences anisotropy and magnetisation at saturation. N. M. B.

Young's moduli of alloys at low temperatures.—See B., 1940, 453.

Crystals of silico-chromium. N. N. Kurnakov and G. B. Boki (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 358—361).—In Cr–Si–Fe alloys of Si contents 27·9—32·4, 33·7—37·5, and ~46·5% the crystals formed are hexagonal prisms, coaxially intergrown tetrahedra, and needles, respectively. With alloys containing >52·4% of Si no pronounced cryst. forms are observed. J. W. S.

Equilibrium diagram of the system iron–silicon–vanadium. R. Vogel and C. Jentzsch-Uschinski (Arch. Eisenhüttenw., 1939—40, **13**, 403—408).—The system contains a ternary compound $(FeSi)_4V_5$ (T) which is the end member of the ternary α series of solid solutions. FeSi and VSi_2 form a simple eutectiferous pseudobinary system; the eutectic has V 15%, m.p. ~1310°. In the ternary system the primary crystallites consist of Fe–V solid solution, FeSi, VSi_2, V_2Si, or T or mixtures of two or more of these according to the composition. There are six four-phase reactions and a fairly wide range of immiscibility. The ternary diagram and various sectional diagrams are given together with photographs of characteristic microstructures in the system. A. R. P.

Cobalt–nickel–silicon system between 0 and 20% of silicon. A. C. Forsyth and R. L. Dowdell (Amer. Inst. Min. Met. Eng., 1940, Tech. Publ. 1170, 15 pp.; Met. Tech., 1940, **7**, No. 2).—A partial diagram of the ternary Ni–Co–Si alloys has been constructed from a study of 76 alloys containing up to 19·3% of Si. Data on thermal analysis and structure, a typical cooling curve, representative photomicrographs, and details of sections through the ternary diagram are given. Ni and Co appear to replace one another in these alloys, producing only two phases in stable equilibrium. The α solid solution alloys are capable of being wrought. Alloys containing >10% of Si are brittle but corrosion-resistant. Alloys containing the α constituent are magnetic. R. B. C.

Oil–water-solubility of argon compared with helium and nitrogen.—See A., 1940, III, 479.

Solubilities of lanthanum, praseodymium, and neodymium chlorides. J. N. Friend and R. W. Hale (J.C.S., 1940, 670—672).—Data are tabulated for $LaCl_3,7H_2O$, $PrCl_3,7H_2O$, and $NdCl_3,6H_2O$ between 0° and 100°. The solubilities of the first two are almost identical up to 80°; that of $NdCl_3,6H_2O$ is appreciably smaller above and slightly greater below 55°. F. L. U.

Thermodynamic derivation of Langmuir's isotherm. G. S. Rushbrooke and C. A. Coulson (Proc. Camb. Phil. Soc., 1940, **36**, 248—251).—Langmuir's adsorption isotherm is derived for the cases of adsorption energy independent of, and varying with, the temp. L. J. J.

Adsorption at interface between two fluids. III. Adsorption of dyes at a mercury–water interface. C. W. Gibby and C. Argument (J.C.S., 1940, 596—600; cf. A., 1936, 1334).—The adsorptions of methylene-blue, Congo-red, Bordeaux extra, indigo-carmine X, and Solway ultra-blue B at a Hg–H_2O interface all pass through a max. with increasing concn., and are always positive. Adsorptions calc. from measured interfacial tensions by Gibbs' equation do not agree with the observed vals., and are sometimes negative. F. L. U.

Radioactive methods of determining ion adsorption at crystal surfaces. II. L. Imre (Kolloid-Z., 1940, **91**, 32—39; cf. A., 1939, I, 316).—An approx. equation is derived according to which the no. of active centres in the surface of an adsorbent

increases exponentially with the heat of dissolution of the adsorbent. The active fraction of the surface calc. by this equation agrees with that found from measurements of the adsorption of $Pb^{··}$ on $PbSO_4$ from various $EtOH-H_2O$ mixtures. It is shown that true adsorption isotherms for such systems as $Pb^{··}-BaSO_4$ can be constructed from measurements with a radioactive indicator, although the indicator itself undergoes only exchange adsorption. F. L. U.

Electrolyte adsorption and activity coefficient. IV. Adsorption of strong acids on carbon and its calculation. S. BROESE (Kolloid-Z., 1940, **91**, 20—32).—The adsorption of HCl and of H_2SO_4 on different varieties of charcoal has been measured over the concn. range 0·005—2M. The linear relationship $f_x = af_{c-x} + b$ (cf. A., 1939, I, 366) is valid over the range of medium concns., and the curves for both acids coincide when de-ashed C is used as adsorbent. F. L. U.

Adsorption of dipoles. A. R. MILLER (Proc. Camb. Phil. Soc., 1940, **36**, 242—243; cf. A., 1940, I, 158).—A correction. L. J. J.

Electrokinetic aspects of surface chemistry. IX. Electric mobilities of quartz and collodion particles in mixtures of horse serum and serum-proteins in relation to the mechanism of film formation. L. S. MOYER and M. H. GORIN (J. Biol. Chem., 1940, **133**, 605—619).—Determination of the electrophoretic mobilities of quartz and collodion particles initially coated with albumin *B* and placed in albumin *A* showed that with the quartz only was the film replaced by albumin *A*. When coated originally with *A*, albumin *B* was not adsorbed. Albumin *B* did not replace globulin, whereas globulin replaced albumin *B* partly on quartz and completely on collodion. In no case did replacement of globulin by albumin occur. The biological significance of these findings is discussed. A. L.

Haidinger's rings in soap bubbles. (SIR) C. V. RAMAN and V. S. RAJAGOPALAN (Proc. Indian Acad. Sci., 1939, **10**, **A**, 317—323).—Interference patterns of uniform and non-uniform soap bubbles have been photographed in transmitted and reflected light and are discussed. W. R. A.

Transformations in monolayers. D. G. DERVICHIAN (J. Chem. Physics, 1940, **8**, 347).—A reply to Harkins and Boyd (A., 1940, I, 159). W. R. A.

Monolayers on solids. I. LANGMUIR (J.C.S., 1940, 511—543).—A lecture incorporating new results and theories. Data on the rate of disappearance of H_2 from mixtures of O_2 and H_2 in contact with glowing W filaments (1500—2500°) are given. While O_2 is present (disappearing at a rate $\propto p_{O_2}$), H_2 also disappears at a rate $\propto p_{H_2}$ but independent of p_{O_2}, and $\ll$ the rate in absence of O_2. These results indicate that there is a stable monolayer of O atoms, over which atoms or mols. of O belonging to a sparse and loosely-bound second layer migrate freely. [O] in the second layer is $\propto p_{O_2}$. Loss of O_2 involves evaporation of WO_3, O being contributed by both layers and the resulting hole in the first layer being usually refilled immediately from the second layer. Disappearance of H_2 can occur only on activation by contact with the bare W surface, *i.e.*, only in such a hole, so long as gaseous O_2 is present. The great difference in stability of the second layer is connected with the short range of adsorption forces; in general the force holding an adsorbed atom on a surface may be $\ll$ or $\gg$ that holding a second adsorbed atom to the first. The first case is exemplified by Cd on glass; it is calc. that the rate of evaporation of Cd atoms from a first layer on glass is > that from a second layer by a factor $\sim 10^{11}$. In the other case a stable monolayer may be formed at pressures $\ll$ saturation, whereas a further layer begins to form only at pressures near saturation. The hyperbolic adsorption isotherm involves the simplifying assumptions that there is one adsorbed atom to each site, and that neighbouring adsorbed atoms do not influence one another. Isotherms resulting from more general considerations are discussed, and an application to the case of Cs on W, allowing for repulsion between Cs dipoles, gives satisfactory agreement. When the adsorbed atoms are larger than the distances between sites, one atom excludes others from neighbouring sites. It is shown that this will result in the adsorbed atoms on a crowded surface forming two identical surface phases separated by boundary regions in which they are less closely packed. Rapid changes of *p* or *T* result in evaporation or condensation in both of these, but slow equilibration can also occur (either by surface migration or by evaporation and condensation) with progressive shortening of the boundaries. This corresponds with certain cases of activated adsorption which have hitherto been supposed to involve diffusion into the interior of the adsorbent. F. J. G.

Permeability of organic polymerides. R. M. BARRER (Trans. Faraday Soc., 1940, **36**, 644—648; cf. A., 1939, I, 317).—Data for the permeability of membranes of Bakelite, ebonite, polyethylene, and Cellophane to He, H_2, and N_2, and of celluloid and nitrocellulose to H_2, are recorded. Vals. of the activation energy of permeation are calc. The results are discussed and related to previous data. F. L. U.

Scattering of polarised light in colloids. R. S. KRISHNAN (Proc. Indian Acad. Sci., 1939, **10**, **A**, 395—398).—When a horizontal beam of polarised light is passed through a colloidal solution the light scattered transversely is depolarised to an extent which depends on the optical properties of the colloid and on the inclination of the plane of polarisation of the incident beam to the vertical. A formula is derived for the depolarisation factor and applied to graphite and As_2S_3 sols and PhMe emulsions; the agreement is not very close. W. R. A.

Dielectric measurements with colloids. H. R. KRUYT and H. KUNST (Kolloid-Z., 1940, **91**, 1—10; cf. A., 1937, I, 615).—Dielectric consts. (ϵ) of sols of Na arabate (I), Na agar, starch (II), AgBr, AgI, and As_2S_3 have been determined with $\lambda\lambda$ 150—1930. Among the lyophilic sols (II) has the smallest and (I) the highest ϵ, corresponding with the relative magnitudes of the micellar charge. Na ions, which have a dehydrating action on (I), do not affect its ϵ; on the other hand $Ba^{··}$ and $[Co(NH_3)_6]^{···}$, which displace $Na^{·}$ and form a less developed double layer, depress it

strongly. Among the lyophobic sols ϵ decreases in the order As_2S_3 >AgI >AgBr, which is also the order of decreasing charge density. These results indicate that a high ϵ in sols is due in large measure to polarisation of the double layer. F. L. U.

Silver organosols. I. Preparation by the reaction between chlorinated oils and silver oxide. II. Particle size and stability. T. MATSUMOTO and S. IWAI (J. Soc. Chem. Ind. Japan, 1940, **43**, 18—20B, 20—22B).—I. Ag sols in sardine, olive, and linseed oils are prepared by boiling a suspension of Ag_2O in a solution of the chlorinated oil in an org. solvent, and removing excess of Ag_2O and the solvent by centrifuging and distillation. The uptake of Ag is independent of the Cl content of the oil, except at high contents, and rises with rising b.p. of the solvent. The sols may be conc. by adding a hydroxylic solvent or mixture, incompletely miscible with the oil, when sols containing 55·8—95·4% Ag separate as a lower layer. The sols are lyophobic and contain particles of Ag and AgCl.

II. The particle size, determined ultra-microscopically or from the Brownian movement displacement, is ~0·1 μ., and decreases with rising temp. of prep. The particles are uncharged. Sols from unchlorinated oils are lyophilic and contain much larger particles. Dispersions of Ag soaps also contain large particles and are lyophilic. In diffuse light the Ag organosols are pptd. Pptn. is accelerated by Ag soaps, but retarded by soaps of Cu, Pb, or Cd. W. A. R.

Colloidal electrolytes. J. W. McBAIN (Nature, 1940, **145**, 702—703).—Mainly a review. Ionic micelles begin to form in very dil. solution and steadily increase throughout parallel to the thermodynamic necessity that the concn. of simple ions likewise must increase throughout the range of stable solution. The lamellar (formerly called "neutral") micelles arise from ion-pairs and higher aggregates, increasing in size and amount until their development is sufficient to produce an X-ray pattern in the solution. L. S. T.

Relations between elasticity, anomalies of flow, and ability to be spun into thread of sols.—See A., 1940, III, 470.

Effect of surface-active substances on mechanical properties and formation of soap coagels. V. MOKIEVSKI and P. REBINDER (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 48—51).—An extension of previous work (cf. A., 1939, I, 259) to soap coagels (curds). Primary crystals of coagels flocculate rapidly. Addition of surface-active substances decreases flocculation markedly and lowers the rigidity of the curd. Mechanical resistance to shear has been measured for (i) a 5% Na stearate coagel containing Bu^aOH, n-C_6H_{13}·OH, n-C_7H_{15}·OH, and n-C_8H_{17}·OH at 10° or 25°, (ii) a 15% Na stearate coagel containing Bu^aOH, n-C_8H_{17}·OH, NH_2Ph, PhOH at 10° or 25°, and (iii) a 15% Na dodecoate coagel containing n-C_8H_{17}·OH. Soaps themselves act on each other like typical surface-active admixtures. W. R. A.

Sodium oleate gels in pinene. M. PRASAD and K. N. MATHUR (Current Sci., 1940, **9**, 119).—Na oleate (I) dissolves in pinene at 140° and sets to a transparent gel, for which the time of setting decreases as the proportion of (I) is increased and as the temp. of setting is lowered. The heat of activation for the setting process and the syneresis are both negative. n is nearly independent of the concn. of (I) but decreases approx. linearly with increasing temp. of setting. F. R. G.

Solubility of β-cellulose in aqueous solutions.—See B., 1940, 435.

Solutions of cellulose in halogenoacetic acids.—See B., 1940, 435.

Solubility and swelling of high polymerides in ternary mixtures. J. N. BRÖNSTED and K. VOLQVARTZ (Trans. Faraday Soc., 1940, **36**, 619—624; cf. A., 1939, I, 319).—Triangular equilibrium diagrams (20°) have been constructed for polystyrene (I) and pairs of liquids consisting of solvent + non-solvent, solvent + swelling agent, non-solvent + swelling agent, and swelling agent + swelling agent, chosen from the following: EtOH, Bu^aOH, $COMe_2$, Me, Et, and Pr^a dodecoates, *iso*-C_5H_{11}·OBz, CH_2Ph·OBz, Bu^a sebacate, MeCN, OH·$[CH_2]_2$·OAc, $Bu^a{}_2O$, $(CH_2Ph)_2O$, and m-cresol. In all cases the final equilibrium is between a binary liquid containing no (I) and a ternary swollen phase. The existence of ternary crit. points is indicated. F. L. U.

Properties of polymerides in solution. XII. Free energy and heat of dilution. System rubber–toluene. K. H. MEYER, E. WOLFF, and C. G. BOISSONNAS. **XIII. Free energy and heat of dilution. System gutta-percha–toluene.** E. WOLFF. **XIV. System cellulose triacetate–tetrachloroethane.** O. HAGGER and A. J. A. VAN DER WYK. **XV. Summary of thermodynamic properties of binary liquid systems.** K. H. MEYER and A. J. A. VAN DER WYK (Helv. Chim. Acta, 1940, **23**, 430—439, 439—441, 484—487, 488—496).—XII. The osmotic pressures (Π) and sp. vols. (V) of 0—5% solutions of rubber in PhMe have been measured at 24·4° and at 35·6° and the partial free energy (ΔG), heat content (ΔH), and entropy (ΔS) changes during dilution are calc. ΔS is > the ideal val. The v.p. of various solutions of rubber in PhMe have been determined and the activity of PhMe in these solutions is deduced.

XIII. Π and V for 1—4% solutions of gutta-percha in PhMe have been measured at 24·4° and 35·6°, and ΔG, ΔH, and ΔS for the dilution are calc. ΔS is > the ideal val.

XIV. Π and V for 0·4—4% solutions of cellulose triacetate in $C_2H_2Cl_4$ have been measured at 24·4° and 35·7°, and ΔG, ΔH, and ΔS for the dilution are deduced. ΔS is < the ideal val. The calc. mol. wt. of the solute is 41,800 ± 2000.

XV. A review of the thermodynamic functions of binary liquid mixtures indicates that for systems containing small mols. ΔH generally determines the sense of the departure of ΔG from the ideal val., but that with strongly exo- or endo-thermic solutions and in systems in which one component has very anomalous properties ΔS diverges considerably from the ideal val. and causes a corresponding change in ΔG. In systems comprising mols. of greatly differing

size ΔS is > the ideal val. and leads to abnormal vals. of ΔG. In solutions containing long-chain macro-mols. ΔS is < the ideal val. and may even be negative, so the divergence of the val. of ΔG from the ideal val. is attributable to anomalous vals. of ΔH. With large compact mols. (hæmoglobin) ΔG has almost the ideal val. In systems containing macro-mols. of limited solubility ΔS is slightly negative; in such cases there is a solvation of the solute and ΔG is $\ll \Delta H$. J. W. S.

Osmotic relations between egg-white and egg-yolk.—See A., 1940, III, 607.

Sediment volumes of multidisperse kaolin powders in electrolyte solutions. II. G. G. Kandilarov (Kolloid-Z., 1940, **91**, 56—61).—The previously noted observations (A., 1940, I, 254) have been extended to tervalent anions and data are now recorded for Na_2HPO_4 and Na_3PO_4. A comparison of the effects of HCl, NaOH, $AlCl_3$, and Na_3PO_4 indicates that in the two last the effects observed are partly due to the $H^{\cdot}$ and OH' produced by hydrolysis. In general, the effects of the various species of ion present are additive. F. L. U.

Electrokinetic studies of silk.—See B., 1940, 434.

Gas equilibria $C_2 \rightleftharpoons 2C$, $S_2 \rightleftharpoons 2S$, $Se_2 \rightleftharpoons 2Se$, and $Te_2 \rightleftharpoons 2Te$. H. Zeise (Z. Elektrochem., 1940, **46**, 38—41).—Vals. of K_p for $C_2 \rightleftharpoons 2C$ (2000—6000° K.) and $S_2 \rightleftharpoons 2S$ (298·1—3000° K.) are recalc. by a thermodynamic-statistical method, using modern spectroscopic vals. for the dissociation energies and the S—S distance. Vals. for the two other equilibria at 1000—2500° K. are also calc., and the results agree with previous experimental data if the ground states of Te_2 and Se_2 are assumed to be of the $^3\Sigma$ type. A. J. E. W.

Errors in the determination of the dissociation constant of a weak acid by the extrapolation method. M. L. Kilpatrick (J. Chem. Physics, 1940, **8**, 306—313).—Mathematical. Equations have been derived expressing the effect of errors in conductivity data for weak acids on the vals. of dissociation consts. and of Λ_0 calc. from these data. Numerical vals. of the errors for aq. solutions are tabulated and the detection of const. errors is discussed. W. R. A.

Dissociation constant of azoimide. (Mlle.) M. Quintin (Compt. rend., 1940, **210**, 625—627).—Aq. solutions of HN_3 ($\ngtr$0·88 M.), prepared from aq. NaN_3 and H_2SO_4, are stable for ~50 days under N_2 in closed vessels free from dust. Vals. of p_k obtained by electrometric titration in aq. KCl solutions of different ionic strengths (μ) give $pK = 4·55$ ($K = 2·8 \times 10^{-5}$) on extrapolation to $\mu = 0$; the slope of the p_k–$\sqrt{\mu}$ curve is $-0·35$ at low μ, in accord with the Debye–Hückel theory. A. J. E. W.

Second ionisation constant and related thermodynamic quantities for malonic acid from 0° to 60°. W. J. Hamer, J. O. Burton, and S. F. Acree (J. Res. Nat. Bur. Stand., 1940, **24**, 269—292).—From e.m.f. measurements on cells of the type Pt,H_2|Na H malonate (I) (m_1), Na_2 malonate (II) (m_2), NaCl (m_3)|AgCl|Ag, the second dissociation const. of malonic acid has been determined at 0—60°. The heats of ionisation and the free energy and entropy changes are calc. for various temp. Solutions containing equal concns. (0·001—0·044M.) of (I), (II), and NaCl form buffers suitable for use as p_H standards. J. W. S.

Ionisation constants of substituted quinolines and tetrahydroquinolines.—See B., 1940, 477.

Equilibria in the system P_2O_5–water. K. I. Zagvozdkin, J. M. Rabinovitsch, and N. A. Barilko (J. Appl. Chem. Russ., 1940, **13**, 29—37).—The equilibria $2H_3PO_4 \rightleftharpoons H_4P_2O_7 + H_2O$; $H_4P_2O_7 \rightleftharpoons 2HPO_3 + H_2O$, shift from left to right with increasing temp. and diminishing pressure. R. T.

Affinity. XCII. Iridium phosphides. K. H. Söffge, M. Heimbrecht, and W. Biltz (Z. anorg. Chem., 1940, **243**, 297—306).—The system Ir–P has been studied by means of X-rays and (in part) of tensimeter curves. IrP_2 and Ir_2P are the only compounds and there are no indications of solid solutions. IrP_2 has ρ_4^{25} 9·15; its dissociation pressure is small at 850°, and it is only slowly attacked by aqua regia. Ir_2P has ρ_4^{25} 16·0, m.p. ~1350°; it is not attacked by aqua regia or by fused Na_2O_2. There appears to be a eutectic at ~1290°, with Ir : P ~4 : 1. The mol. vol. increment for P is 9·7 in IrP_2 and 9·0 in Ir_2P. F. J. G.

(A) **Equilibrium between metallic and non-metallic phases in the molten state.** J. K. Delimarski. (B) **Equilibrium $Cd + PbBr_2 \rightleftharpoons CdBr_2 + Pb$, in molten aluminium bromide–potassium bromide solution.** J. K. Delimarski and L. S. Berenblum (Mem. Inst. Chem. Ukrain. Acad. Sci., 1940, **6**, 93—129, 131—147).—(A) The literature is reviewed.

(B) The reaction $Cd + PbBr_2 \rightleftharpoons CdBr_2 + Pb$ proceeds according to the law of mass action in molten $AlBr_3$–KCl at 360—460°; its conformity with this law is the closer the more dil. are the solutions. R. T.

Vaporisation equilibria. M. Gilbert (Chem. Met. Eng., 1940, **47**, 234—235, 249).—A series of curves is plotted which enables the % vaporisation of a given mixture to be obtained with only 3 preliminary trial calculations. The curves relate to complex mixtures obeying Henry's and Raoult's laws. D. F. R.

Vapour pressure of saturated solutions and solubility in the system CaO–P_2O_5–H_2O. A. P. Belopolski, M. T. Serebrennikova, and A. V. Bilevitsch (J. Appl. Chem. Russ., 1940, **13**, 3—8).—The results of Bassett (cf. A., 1908, ii, 675) are confirmed. The v.p. of the saturated solutions is > that of aq. H_3PO_4 of an identical [P_2O_5], at temp. >25°. R. T.

System oxygen–hydrogen–molten iron.—See B., 1940, 448.

Mutual system: monoammonium phosphate–sodium nitrate–water. I, II. S. J. Sohpunt (J. Appl. Chem. Russ., 1940, **13**, 9—18, 19—28).—I. The solid phases forming in the system $NH_4H_2PO_4$ (I)–NaH_2PO_4 (II)–H_2O, at −10° to 30°, are (I), $NaH_2PO_4,2H_2O$ (III), and ice. The ternary cryo-

hydric point is at $-12{\cdot}1°$, with (I) 8, (II) 26·6, and H_2O 65·4%.

II. The solid phases forming in the system $NaNO_3$–(II)–H_2O at $-10°$ to 30° are $NaNO_3$, (III), and ice. The ternary cryohydric point is at $-19{\cdot}4°$, with $NaNO_3$ 30·8, (II) 7·4, and H_2O 61·8%. R. T.

Surface energy of cadmium oxide and heat of formation of cadmium hydroxide. R. Fricke and F. Blaschke (Z. Elektrochem., 1940, **46**, 46—49).—Dehydration of cryst. $Cd(OH)_2$ [pptd. from aq. $Cd(NO_3)_2$ by NaOH] at 350° or 800°, respectively, yields a greenish-yellow or a bluish-black form of CdO. The former has a mol. heat content (determined by dissolution in HF + HCl + H_3PO_4) 0·56 kg.-cal. > that of the latter. The two forms are shown by *X*-ray examination to differ only in particle size (190, >2500 A.), and the total surface energy of CdO is deduced to be ≮500 ergs per sq. cm. The heats of formation of $Cd(OH)_2$ from the two forms are 5·30 and 4·74 kg.-cal. per g.-mol., respectively. A. J. E. W.

Heats of formation of aluminium oxide (corundum) and lanthanum oxide. W. A. Roth, U. Wolf, and O. Fritz (Z. Elektrochem., 1940, **46**, 42—45).—Using Al of high purity and improved technique (ignition by Cellophane), the heat of formation of corundum is found to be $402{\cdot}9\pm0{\cdot}3$ kg.-cal. per g.-mol., at 22° and const. pressure; the heat of formation of Al_4C_3 is then corr. to 50 ± 3 kg.-cal. The val. for La_2O_3 is 539 ± 4 kg.-cal., under similar conditions. La_2O_3 exists in two modifications, the form stable at low temp. having the higher mol. vol. A. J. E. W.

Heat of formation of chromic oxide. W. A. Roth and U. Wolf (Z. Elektrochem., 1940, **46**, 45—46).—The heat of formation is $268{\cdot}0\pm0{\cdot}6$ kg.-cal. per g.-mol. at ~20° and const. pressure. The val. for CrO_3 is deduced to be $137{\cdot}1\pm0{\cdot}4$ kg.-cal., under similar conditions. A. J. E. W.

Calculation of ionic heat capacities in solution. D. H. Everett and C. A. Coulson (Trans. Faraday Soc., 1940, **36**, 633—643).—Methods of statistical mechanics are applied to the approx. calculation of the heat capacity change associated with the process $HA + H_2O = H_3O^{\cdot} + A'$. It is shown that the observed change is mostly accounted for by the influence of the ions on the freedom of rotation of H_2O mols. in their neighbourhood (cf. A., 1940, I, 73). F. L. U.

E.m.f. of Daniell's cells in molten salts. E. M. Skobetz and N. S. Kavetzki (Mem. Inst. Chem. Ukrain. Acad. Sci., 1940, **6**, 149—162).—The e.m.f. of the cells Pb|5% $PbCl_2$||5% AgCl, $CuCl_2$ or $NiCl_2$| Ag, Cu or Ni (the solvent is fused KCl–NaCl–$SrCl_2$, at 600—800°) is conveniently measured using an unglazed porcelain diaphragm between the half-cells. The results obtained with glass diaphragms vary according to the type of glass used. The e.m.f. falls linearly with rising temp. R. T.

Oxidation–reduction potentials of complex ammoniates of platinum. A. A. Grünberg, V. N. Laurentiev, and B. V. Ptitzin (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 52—53).—The oxidation–reduction potentials (*E*) at 25° of (*a*) $[Pt(NH_3)_3Cl]^{\cdot} + 2Cl' \rightleftharpoons [Pt(NH_3)_3Cl_3]^{\cdot} + 2e$, (*b*) $[Pt(NH_3)_2Cl_2] + 2Cl' \rightleftharpoons [Pt(NH_3)_2Cl_4] + 2e$ (*cis* and *trans*), (*c*) $[Pt(NH_3)Cl_3]' + 2Cl' \rightleftharpoons [Pt(NH_3)Cl_5]' + 2e$ have been measured using cells of the type Hg|Hg_2Cl_2,KCl|KCl,KNO_3|R-Pt^{II} R-Pt^{IV}, N-HCl|Pt'. *E* of the system $[Pt(NH_3)_4]^{\cdot\cdot} + 2Cl' \rightleftharpoons [Pt(NH_3)_4Cl_2]^{\cdot\cdot} + 2e$ was obtained by dissolving $[Pt(NH_3)_4]Cl_2$ in N-HCl, titrating with $KBrO_3$ until it was half oxidised, and keeping the mixture in a thermostat until a const. e.m.f. was obtained. *E* increases almost regularly with the no. of Cl in the complex ion. The vals. of *E* for the isomerides of (*b*) are nearly identical. W. R. A.

Oxidation–reduction potentials of quinones derived from carcinogenic hydrocarbons.—See A., 1940, III, 505.

Polarisation in deposition of bismuth at the cathode. O. Essin, M. Loschkarev, Z. Levitina, and K. Rusanova (J. Appl. Chem. Russ., 1940, **13**, 56—65).—In the electrolysis of aq. $BiCl_3$ or $Bi(NO_3)_3$ polarisation is due chiefly to concn. differences, and may largely be eliminated by stirring. Residual polarisation appears to be connected with processes of corrosion and recrystallisation of the deposit. In the case of $Bi_2(SO_4)_3$ chemical polarisation is also evident, in the form of retardation of discharge of ions. Addition of colloidal solutions (sulphite lyes) increases polarisation. R. T.

Mechanism of aromatic side-chain reactions, with special reference to polar effects of substituents. X. Depolarisation potentials of *p*-substituted benzaldehydes in acid, neutral, and alkaline media at the dropping mercury cathode. J. W. Baker, W. C. Davies, and (Miss) M. L. Hemming (J.C.S., 1940, 692—702).—Depolarisation potentials of p-$C_6H_4R{\cdot}CHO$ (R = H, Me, Et, Pr^{β}, Bu^{γ}, Cl, OMe, NMe_2) have been measured polarographically in media of various p_H. It is confirmed that reduction occurs in two stages; the first, in acid and neutral solutions, requires 1 ***F*** and 1 atom of H per mol. of aldehyde, whilst the second occurs in acid, neutral, and alkaline media and also requires 1 ***F*** per mol. An explanation of the results is offered, on the basis of the relative importance of the combined polarisation and polarisability effects of the alkyl substituents (cf. A., 1939, I, 453). F. L. U.

Polarographic analysis of mixtures of aldehydes and peroxides.—See A., 1940, II, 264.

Mechanism of the exchange reaction between gaseous bromine and hydrogen bromide. W. F. Libby (J. Chem. Physics, 1940, **8**, 348).—Polemical against Liberatore and Wiig (A., 1940, I, 221). A bimol. mechanism is advanced. W. R. A.

Exchange reactions between gaseous alkyl bromides, bromine, and hydrogen bromide. L. C. Liberatore and E. O. Wiig (J. Chem. Physics, 1940, **8**, 349).—Gaseous Br_2 containing Br* shows no exchange when mixed with EtBr for ≯2 hr. Similar results have been found with HBr and EtBr. Exposure of a Br_2–EtBr mixture to the light of a 500-w. W lamp for 9 hr. at room temp. pro-

duced no exchange; at higher temp. exchange occurred. These results agree with an atom chain mechanism (A., 1940, I, 221). The bimol. mechanism postulated by Libby for the $HBr–Br_2$ exchange (preceding abstract) is criticised. W. R. A.

Exchange of oxygen between NO and NO_2. E. LEIFER (J. Chem. Physics, 1940, **8**, 301—303).—The exchange reaction $^{14}NO + ^{15}NO_2 = ^{15}NO + ^{14}NO_2$ has been investigated at $-35°$ and at a total pressure of 2·5 cm. Hg. It is assumed that N_2O_3 is formed as an intermediate product. The reaction is very fast and a lower limit of the rate coeff. (k) is 10^6 c.c. mol.$^{-1}$ sec.$^{-1}$ The equilibrium const. is $0·96 \pm 0·02$ compared with the val. 0·967 calc. from spectroscopic data. The high val. of k indicates a small energy of activation for the formation of N_2O_3, probably <1 kg.-cal. The energy of activation for the dissociation of N_2O_3 into NO and NO_2 is $\sim 10·5$ kg.-cal. The exchange between NO and solid N_2O_3 (high content of ^{15}N) at $-118°$ has been investigated; solid N_2O_3 appears to be unstable and capable of existence only in equilibrium with its components. W. R. A.

Polymorphism. V. Linear rate of transformation of monoclinic into rhombic sulphur. P. G. ELIAS, N. H. HARTSHORNE, and J. E. D. JAMES (J.C.S., 1940, 588—595).—The linear rate of transformation of β- into α-S in polycryst. films at 20°, 30°, and 40° has been measured. In the case of a straight interface started by inoculation of the film edge the rate is const. at const. temp. up to a distance of 1·5 mm. The rate increases with increase in film thickness over the range 0·03—0·15 mm. The growth of nuclei in the interior of a film proceeds at const. rate in all directions in the plane of the film. The calc. apparent activation energy is $\sim$15,000 g.-cal. C. R. H.

Hydrolysis of salts in solution. H. F. BROWN and J. A. CRANSTON (J.C.S., 1940, 578—583).—Continuing earlier investigations (cf. A., 1937, I, 245; 1938, I, 34), the p_H vals. and hydrolysis consts. of solutions of $ZnSO_4$, $Na_2C_2O_4$, $NaHCO_3$, KCl, K_2CrO_4, $K_2Cr_2O_7$, and $BeSO_4$ at various dilutions are recorded. In the case of salts which are only slightly hydrolysed it is essential that the solutions be guarded against contamination by atm. CO_2; a suitable apparatus for this purpose is described. C. R. H.

Sulphur iodide. I. Formation of sulphur monoiodide. II. Rate of decomposition and spectroscopic studies. M. R. A. RAO (Proc. Indian Acad. Sci., 1940, **11**, **A**, 162—174, 175—184).—I. When a CCl_4 solution of S_2Cl_2 is treated with dry solid KI, S monoiodide, S_2I_2, is formed. In dil. solution it has a yellow colour; it decomposes rapidly into S and I at room temp., but is stable at low temp. It undergoes photochemical decomp. and, with NaOH, yields compounds analogous to those obtained from S_2Cl_2.

II. The decomp. of S_2I_2 under various conditions has been investigated. The velocity of decomp. is not appreciably affected by the nature or extent of the surface. In conc. CCl_4 solutions the rate is $>$ that in dil. solutions, and the rate at 30° is $\sim$4 times that at 0°. S_2I_2 solutions absorb all λλ $<$4770 A. W. R. A.

Thionyl iodide. I. Formation of thionyl iodide. II. Rate of decomposition and spectroscopic studies. M. R. A. RAO (Proc. Indian Acad. Sci., 1940, **11**, **A**, 185—200, 201—205).—I. By shaking $SOCl_2$ in CCl_4 with solid KI at 0° SOI_2 is formed. It is very unstable and is readily decomposed, particularly by light. In the hydrolysis of SOI_2 with (a) NaOH, (b) aq. $CdCO_3$, (c) H_2O the following reactions occur: (i) $2SOI_2 \rightarrow S + SO_2 + 2I_2$; (ii) $SOI_2 + H_2O \rightarrow 2HI + SO_2$; (iii) $2SOI_2 + H_2O \rightarrow H_2S_2O_3 + 2I_2$; (iv) $S_2I_2 + 2H_2O \rightarrow H_2S + SO_2 + 2HI$, of which (i) and (ii) predominate. The % of each reaction for various conditions has been investigated. The amount of $Na_2S_2O_3$ formed when SOI_2 is hydrolysed is $>$ with $SOBr_2$. $SOCl_2$ gives no $Na_2S_2O_3$.

II. SOI_2 (in CCl_4) is catalytically decomposed on the surface of KI and the rate of decomp. increases with temp. All λλ $<$5930 A. are absorbed by SOI_2. W. R. A.

Reaction between phosphorus and iodine in carbon tetrachloride solution. D. WYLLIE, M. RITCHIE, and E. B. LUDLAM (J.C.S., 1940, 583—587).—The reaction between P and I in CCl_4 where the amount of I is $<$ that required to form P_2I_4 has been investigated. The reaction rate, k, increases with increasing [P], especially at high [P], *e.g.*, a seven-fold increase in $[P_4]$ gives approx. 160-fold increase in k when $[I_2] = 0·002$ mol. per l. The approx. constancy of k ratios for different [I] at const. [P] suggests that in the earlier stage I is being used in a secondary process apart from the disappearance of P. A six-stage chain mechanism involving the conversion of white into red P via P_4I_2 and the formation of P_2I_2 which reacts with I_2 to form P_2I_4 is suggested. Small quantities of MeOH, EtOH, $COMe_2$, Et_2O, and H_2O considerably increase k. With C_6H_6 and PhMe the increase is smaller, and there is no increase with $CHCl_3$, CS_2, C_6H_{14}, and *cyclo*hexane. Large increases in k are caused by those liquids in which I dissolves to a brown solution. A few experiments with P and Br are described. C. R. H.

Steric course of the hydrolysis of α-phenylethyl chloride in acetone containing mercuric chloride. D. R. READ and W. TAYLOR (J.C.S., 1940, 679—683).—The rate of change of rotatory power of CHPhMeCl in dry $COMe_2$ in presence of $HgCl_2$ is const. during any one run, and is independent of [CHPhMeCl] but $\propto [HgCl_2]^2$. Addition of 5% of H_2O slightly increases the rate and this increase continues during the run. This increase has been traced to HCl formation. The rate of hydrolysis in 95% $COMe_2$ is const. at first but rapidly decreases. At the higher $[HgCl_2]$ the rate of racemisation and the initial rate of hydrolysis are the same, but at the lower concns. the latter is $\gg$ the former. Since, therefore, hydrolysis proceeds mord quickly than racemisation it cannot be subsequent to racemisation and the two mechanisms must be distinct. It is also shown that hydrolysis at first occurs with retention of configuration. The subsequent decrease in the rate of hydrolysis and the slight inversion of the final product show that in the later stages hydrolysis occurs with inversion. C. R. H.

Velocity of transformation of 1 : 3 : 5-triketones into 2 : 6-disubstituted γ-pyrones. I. Velocity of transformation of acetonedioxalic ester into chelidonic ester. S. S. Deshapande, W. V. Bhagwat, and C. W. Subnis (J. Indian Chem. Soc., 1940, **17**, 60—64).—The transformation of $CO(CH_2\cdot CO\cdot CO_2Et)_2$ into Et chelidonate in $COMe_2$ or aq. MeOH in presence of HCl is unimol. F. J. G.

Luminescence of luminol. E. Baur (Helv. Chim. Acta, 1940, **23**, 449—454).—From measurements of the intensity of the luminescence emitted from an alkaline solution of luminol (3-aminophthalhydrazide) oxidised by H_2O_2 in presence of a trace of hæmin as catalyst, it is inferred that the reaction producing the luminescence is of the second order. It is identified with the bimol. decomp. of the activated form of an initially formed peroxide, with liberation of a mol. of O_2. Inhibitors (metol, quinol, cysteine hydrochloride, Na_2S, adrenaline, and ascorbic acid) are supposed to deactivate the peroxide to its ground state, in which it does not emit visible radiation on decomp. J. W. S.

Velocity of oxidation of molten iron with pure oxygen. M. S. Fortunatov and V. I. Michailovskaja (Mem. Inst. Chem. Ukrain. Acad. Sci., 1940, **6**, 83—92).—The velocity of oxidation of Fe rises gradually from 1550° to 1650°, and very abruptly from 1650° to 1750°. The velocity appears to be determined at <1650° by that of diffusion of O_2 through the oxide layer, which is absent at >1650°. R. T.

Corrosion of metals and alloys.—See B., 1940, 456.

Rôle of ozone as an oxidation catalyst. Quantitative study of the effect of dilution of oxygen and ozone in the ozonisation of benzaldehyde and butaldehyde ; evaluation of the length of the reaction chains. E. Briner and G. Papazian (Helv. Chim. Acta, 1940, **23**, 497—513).—The effects of the $[O_3]$ and $[O_2]$ on the velocity of oxidation (v) of PhCHO and $Pr^{a}CHO$ in CCl_4, C_6H_{14}, or *iso*-C_8H_{18}, and the consumption of these gases during the reaction have been investigated. At const. $[O_3]$ an increase in the $[O_2]$ increases v, the effect being most marked at low $[O_2]$. At const. $[O_2]$ the mol. ratio of O_2 and O_3 consumed increases with decreasing $[O_3]$, until for $Pr^{a}CHO$ in O_2 containing 10^{-9}% of O_3 it is ~200,000. At const. $[O_2]$, v plotted against log $[O_3]$ yields a simple curve which can be used for the determination of very low $[O_3]$. J. W. S.

Stabilisation of hydrogen peroxide solutions.—See B., 1940, 489.

Catalytic action of 8-hydroxyquinoline on the oxidation of *p*-phenylenediamine. F. Bernheim and P. Handler (J. Amer. Chem. Soc., 1940, **62**, 984).—8-Hydroxyquinoline (I) catalyses the oxidation of *p*-$C_6H_4(NH_2)_2$ to a deeply coloured quinonediamine polymeride (reduced by $Na_2S_2O_4$ and hydrolysed by acid to NH_3) and further oxidation products. This reaction is unaffected by metals, CN′, or P_2O_7'''', is fastest at p_H ~6·5 and much slower in alkali. (I) has no effect on the oxidation of *o*-$C_6H_4(NH_2)_2$, *o*- or *p*-$C_6H_4(OH)_2$ in acid or alkali, and little on that of *p*- or *o*-$NH_2\cdot C_6H_4\cdot OH$ at p_H 7·8. 2-Hydroxyquinoline and other quinoline derivatives are not catalysts. R. S. C.

Production of hydrogen by [catalytic] thermal decomposition of methane and of petroleum fractions.—See B., 1940, 441.

Influence of chemical activation of refractories on the combustion of fire-damp. M. B. Ravitsch and B. A. Zacharov (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 65—68).—The kinetics of the combustion of a stoicheiometric ratio of H_2 and O_2 (initial pressure ~1 mm. Hg) on the surface of various refractories have been investigated from 100° to 950°. At low temp. and pressure the rate of combustion (k) of H_2 on the surface of chamotte brick is increased by impregnating the surface of the brick with oxides of Ni or Fe. Using Ural dunite k is > for activated chamotte. The val. of k at 400° with activated chamotte is equal to that for unactivated chamotte at 950°. W. R. A.

Velocity of hydrogenation of aromatic and unsaturated hydrocarbons. IV. A. V. Lozovoi and M. K. Djakova (J. Gen. Chem. Russ., 1940, **10**, 1—10).—The velocity of hydrogenation ($Ni-Al_2O_3$ catalyst; 40—70°/35 atm.) of a no. of hydrocarbons is, relative to $C_6H_6 = 1$, as follows: hexa-, very small, penta-, 0·005, tetra- 0·038, tri- 0·1, di- 0·22—0·34, and mono-alkylbenzene 0·4—0·5, $C_{10}H_8$ 3·3, *cyclo*hexene 150, 1-methyl- 5·1, and 3-methyl-*cyclo*hexene 134, *cyclo*pentene 294—470, Δ^{a}-hexene 306, styrene 900. R. T.

Catalytic synthesis of hydrocarbons.—See B., 1940, 427.

Catalytic effect of metals on ageing of lubricating oil.—See B., 1940, 425.

Action of vanadium catalysts in conversion of acetylene and water vapour into acetone.—See B., 1940, 428.

Catalytic cyclisation of aliphatic into aromatic hydrocarbons.—See B., 1940, 428.

Effect of animal charcoal on ascorbic acid.—See A., 1940, III, 595.

Theory of aqueous electrolysis. P. Jolibois (Helv. Chim. Acta, 1940, **23**, 405—414).—The importance of the hydration of ions in solution and the orientation of the H_2O mols. in an electric field is discussed. It is suggested that the high mobilities of H˙ and OH′ ions arise through the circumstance that when they reach suitable positions relative to a H_2O mol. oriented in the electric field the ions react with the mol. forming a new ion. This leads to an immediate advance of 1·51 or 0·82 A. for H˙ or OH′ ion, respectively. In the cell Pt,O_2|electrolyte|Pt,H_2 it is supposed that the hydrate H_2O mols. orient themselves with the O and H atoms directed towards the H_2 and O_2 electrodes, respectively, thus permitting the gas on the electrodes to react with them and form new H_2O mols. During electrolysis of a salt solution it is supposed that when hydrated metal ions reach the cathode the metal oxide and at. H are formed, this being followed in some cases by reduction of the oxide by the at. H. This view explains the cathodic deposition of Ag_2O and Cu_2O by electrolysis

of suitable solutions, and also the formation of CuO and non-appearance of the Cu spectrum during electrolysis of aq. $CuSO_4$ with the cathode above the solution and making contact to it through an arc. Oxides are also deposited when an electrolyte solution is separated from the electrodes by distilled H_2O. When aq. KOH is electrolysed, using a cylindrical Fe cathode closed at the lower end by a thin mild steel plate, alkaline $Cu(OH)_2$ or $K_3Cu(CN)_4$ inside the Fe tube is reduced. This reduction is attributed to passage of the at. H through the steel. The theory is also discussed in relation to Faraday's laws of electrolysis. J. W. S.

Electrolytic separation of iodine from halide solutions and bore-hole water.—See B., 1940, 442.

Bismuth oxide as active material of the negative electrode in an alkaline storage cell.—See B., 1940, 460.

Electrometallurgy of antimony, bismuth, lanthanum, cerium, and praseodymium.—See B., 1940, 457.

Electrodeposition of chromium from potassium dichromate baths.—See B., 1940, 457.

Bath for electrolytic rhodium-plating of metals.—See B., 1940, 458.

Electrochemical nitration of hydrocarbons.—See B., 1940, 460.

Rôle of ozone as an oxidation catalyst. Sensitivity of the reactive aldehydes to post-photochemical reactions and to the presence of various materials, notably hæmin and nitric oxide. E. BRINER and G. PAPAZIAN (Helv. Chim. Acta, 1940, **23**, 542—548).—The continuation of photochemical reaction chains after cessation of illumination can produce acidity in solutions of $Pr^{\alpha}CHO$ in CCl_4 of the same order as is produced by gases containing 10^{-5}—10^{-6}% of O_3. The first fractions obtained during the distillation of $Pr^{\alpha}CHO$ in N_2 are, however, free from this continued reaction. Hæmin causes an acceleration of the oxidation of $Pr^{\alpha}CHO$, which at low $[O_3]$ is additive to the effect of the O_3. The effect on $Pr^{\alpha}CHO$ of the O_3 present in normal air is suppressed completely by the presence of 10^{-3}% of quinol in the solution, whilst 10^{-4}% has still a marked effect. Similarly 10^{-7}% of NO in the air has a strong retarding effect on the oxidation. J. W. S.

Photo-oxidation of sulphides. G. CALCAGNI (Annali Chim. Appl., 1940, **30**, 147—152).—ZnS, FeS_2, Sb_2S_3, and As_2S_3 in presence of H_2O at room temp. are oxidised to the corresponding sulphate on exposure to daylight. The effect with PbS is slight, whilst CuS and HgS are not oxidised. A method of analysis of Sb_2S_3 is described. F. O. H.

Photochemical analysis. G. CALCAGNI (Annali Chim. Appl., 1940, **30**, 153—156).—The hydrolysis of $CaCN_2$ and the oxidation of dil. aq. NH_3 to HNO_2 and HNO_3 (both systems in presence of MnO_2, Al_2O_3, Fe_2O_3, Cr_2O_3, TiO_2, SiO_2, or V_2O_5) are accelerated by exposure to daylight. F. O. H.

Poly-substituted sodium phosphomolybdates. E. A. NIKITINA (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 370—371).—By treatment of aq. $Na_3H_4P(Mo_2O_7)_6,xH_2O$ with successive mol. quantities of NaOH, compounds of the type $Na_yH_zP(Mo_2O_7)_6,xH_2O$ are formed, where $y = 4$—11. Attempts to replace a twelfth H by Na lead to breakdown of the mol., as the solution becomes alkaline. J. W. S.

Alteration of metals by organic acids dissolved in non-aqueous liquids. R. DUBRISAY (Compt. rend., 1940, **210**, 533—534; cf. A., 1939, I, 154).—The corrosion of Cu by PhMe and xylene solutions of stearic and palmitic acids in presence of H_2O is studied. The results suggest that the action of air and H_2O produces a sparingly sol. Cu compound, which reacts with the acid at the interface between H_2O and the org. liquid. Zn and Cd give similar results, but Al is not attacked. A. J. E. W.

Reduction of organic copper complexes by cold formaldehyde. P. MISCIATTELLI (Atti X Congr. Internaz. Chim., 1938, IV, 689).—The systems $CuSO_4$–NaOH–tartrate and –glycerol were studied with respect to the conditions for pptn. of Cu or Cu_2O by CH_2O. F. O. H.

Isolation of rare earths from apatite.—See B., 1940, 441.

Removal of carbon dioxide from distilled water. F. NYDAHL and H. ARNFELT (Svensk Kem. Tidskr., 1940, **52**, 17—19).—CO_2 is removed by aërating at reduced pressure, equilibrium vals. being obtained after passing 2·7 l. of air in 40 min. at 20 mm. Hg. At 760 mm. Hg equilibrium is attained only after passing 6 l. of air per min. for 120 min. M. H. M. A.

Lead etching effect. J. A. SMYTHE (Nature, 1940, **145**, 704).—When polished surfaces of some ancient leads containing inclusions of PbO are etched with boiling, dil. HCl, dendritic crystals of Pb appear at the junction of Pb and PbO, and grow outwards from the Pb during the etching process. This is due to pptn., during etching, of Pb from the solution of $PbCl_2$ formed. L. S. T.

Carbonyls of group VI metals. I. K. A. KOTSCHESCHKOV, A. N. NESMEJANOV, M. M. NADJ, I. M. ROSSINSKAJA, and L. M. BORISOVA. **II.** K. N. ANISIMOV and A. N. NESMEJANOV (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 54—57, 58—59).—I. Reduction of WCl_6 and $MoCl_5$ at −10° to 0° by CO and Fe or Zn dust in $Et_2O + C_6H_6$ yields $M(CO)_6$. Improved yields of $W(CO)_6$ and $Mo(CO)_6$ were obtained respectively in dry Et_2O and $COMe_2$. The intermediate formation of a sub-halide, unstable at low temp., is tentatively advanced to explain, *inter alia*, the low yields of ~10—14%.

II. Increased initial pressures of CO improve the yields of $W(CO)_6$ and $Mo(CO)_6$. $W(CO)_6$ can also be prepared from $WOCl_4$ in Et_2O by the method given above. Carbonyls could not be prepared from WO_3 or from $CrCl_3$. W. R. A.

Separation of uranium isotopes. W. KRASNY-ERGEN (Nature, 1940, **145**, 742—743).—A procedure

for separating ^{235}U, based on the thermal diffusion method of Clusius and Dickel (A., 1939, I, 224) and using UF_6, is described. L. S. T.

Complex compounds of platinum with complex amines. II. A. M. RUBINSCHTEIN (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 372—375).—5-Bromo-2-aminopyridine (I) (2 mols.) with K_2PtCl_4 (1 mol.) in aq. EtOH yields after 2—3 hr. a ppt. of the *complex* $PtCl_2$,2(I), readily sol. in C_5H_5N giving a solution which deposits crystals of $(C_5H_5N)_2PtCl_2$ (II). When treated with $CS(NH_2)_2$ (4 mols.), (II) (1 mol.) yields the *complex* $(C_5H_5N)_2\{CS(NH_2)_2\}_2$,$PtCl_2$, indicating the *trans*-configuration of (II). 5-Chloro-2-aminopyridine (III) and K_2PtCl_4 in aq. EtOH react very slowly, with deposition of a light green ppt. of the *complex* $PtCl_2$,2(111), which when heated with C_5H_5N on the H_2O-bath yields (II). Chloropyridine (IV) and K_2PtCl_4 in aq. EtOH react extremely slowly and after several days deposit a ppt. of the *complex* $PtCl_2$,2(IV) (V). On passing Cl_2 through an aq. suspension of (V) an orange deposit of the *complex* $PtCl_4$,2(IV) is obtained. When heated with C_5H_5N, (V) dissolves, but no ppt. deposits; on addition of K_2PtCl_4, however, a light pink ppt. of $[(C_5H_5N)_4Pt][PtCl_4]$ is produced. When the solution is evaporated in a desiccator a white ppt. of $4C_5H_5N,PtCl_2,3H_2O$ is deposited, whilst addition of EtOH and Et_2O to such a solution gives a ppt. of $4C_5H_5N,PtCl_2$. When dried this loses C_5H_5N and yields $2C_5H_5N,PtCl_2$. J. W. S.

Electro-capillary method of qualitative analysis. S. I. DJATSCHKOVSKI and A. F. ORLENKO (J. Gen. Chem. Russ., 1940, **10**, 82—96).—An analytical procedure is described. R. T.

Identification of perchlorate, persulphate, and some other inorganic acid residues with Zwikker's reagent. Sensitive reaction for copper. G. H. WAGENAAR (Pharm. Weekblad, 1940, **77**, 465—468).—Characteristic microcryst. ppts. are obtained with Zwikker's reagent ($CuSO_4$–C_5H_5N) and ClO_4' (1 : 100), S_2O_8'' (1 : 1000), S_2O_3'' (1 : 1500), CrO_4'' (1 : 300), and MnO_4'' (1 : 3000), the sensitivity being given in parentheses. Amorphous ppts. are obtained with I′, CN′, CNS′, and molybdate. Cu˙˙ (1 : 25,000) can be detected by adding a drop of C_5H_5N and N-$KMnO_4$. S. C.

Sensitive test for iodide and nitrite. C. L. WILSON (Chem. and Ind., 1940, 378).—One drop of 2N-AcOH is placed on test paper, and a drop of test solution, followed by 1 of 0·1N-KNO_2, is allowed to run from a capillary on to its centre. A blue ring shows the presence of I′; limit of identification, 0·025 µg. Many brands of paper sold for drop reaction tests contain sufficient starch to give the starch–I′ colour. L. S. T.

Determination of iodine in soils, plant material, and water.—See B., 1940, 475.

Photocolorimetric determination of fluorine in air, by means of zirconium–alizarin. M. M. RAINES and S. V. KAZATSCHKOVA (J. Appl. Chem. Russ., 1940, **13**, 153—156).—5 l. of air are aspirated through two paraffined wash-bottles, each containing 10 ml. of H_2O. The solution is transferred to a cylinder, and 0·5 ml. of indicator [0·034% Na alizarinsulphonate in 0·174% $Zr(NO_3)_4$], 0·5 ml. of 3N-H_2SO_4, and 0·5 ml. of 3N-HCl, and H_2O to 25 ml. are added. The resulting coloration is compared with that given by a series of standards. The method serves for determination of 1—20 µg. F. R. T.

Rapid determination of oxygen in steel.—See B., 1940, 451.

Starch iodide method of ozone analysis. C. E. THORP (Ind. Eng. Chem. [Anal.], 1940, **12**, 209).—Addition of an $AlCl_3$ + NH_4Cl buffer solution increases the sensitivity of the KI reaction from 0·0013 to 0·00062 mg. of O_3 per c.c. of 2N-KI, without introducing the error caused by acidifying the KI. The buffered KI solution is stable for 3 hr. in light, and for >40 hr. in the dark. Precautions to be observed in removing H_2O_2 and oxides of N, and in preventing decomp. of the O_3, are discussed. L. S. T.

Colorimetric micro-determination of sulphur in gases.—See B., 1940, 421.

Rapid simultaneous determination of sulphur and chlorine in coal and coke.—See B., 1940, 419.

Determination of selenium in glass.—See B., 1940, 443.

Determination of tellurium in tin-rich alloys.—See B., 1940, 453.

Potentiometric determination of hydroxylamine and hydrazine in alkaline solution. H. T. S. BRITTON and (MISS) M. KÖNIGSTEIN (J.C.S., 1940, 673—676).—NH_2OH and N_2H_4 can be determined by potentiometrically titrating solutions of alkaline Cu tartrate or ammoniacal $CuSO_4$ at 90°, using bright Pt foil or Cu as indicator electrode. NH_2OH is oxidised to N_2O and N_2H_4 to N_2. It is preferable to carry out the titrations in N_2. Beyond the end-point the Pt electrode functions as a Cu electrode in equilibrium with Cu˙˙, the electrode acquiring a coating of Cu as a result of the reduction of Cu_2O. C. R. H.

Spectral determination of arsenic, antimony, bismuth, and tellurium in lead.—See B., 1940, 453.

Test for arsenic in lead alloys.—See B., 1940, 453.

Determination of silicon in aluminium–silicon alloys.—See B., 1940, 455.

Rapid determination of silicon in iron and steel.—See B., 1940, 450.

Determination of silica and R_2O_3 in Portland cement.—See B., 1940, 446.

Detection of traces of carbon monoxide in gas mixtures.—See B., 1940, 421.

Determination of carbonate in small amounts of [building] materials.—See B., 1940, 446.

Determination of small amounts of cyanide in water.—See B., 1940, 502.

Determination of free sodium cyanide in brass-plating solutions.—See B., 1940, 457.

Colorimetric micro-determination of sodium. B. T. MULWANI (J. Univ. Bombay, 1940, [ii], **8**, 128—

134).—An extract containing Na (0·01—0·60 mg.) is diluted to 2 c.c., and stirred with 4 c.c. of Zn uranyl acetate reagent until crystallisation begins. After keeping for 1 hr. at 0° the mixture is centrifuged. The ppt. is washed with ice-cold EtOH saturated with Na Zn uranyl acetate and is then dissolved in H_2O, treated with glacial AcOH (1 drop) and 20% aq. $K_4Fe(CN)_6$ (0·5 c.c.), and made up to 25 c.c. The colour developed after 1 min. is compared with standards. Ca, Mg, Fe, Al, and Mn or HCl ($\not>$2N.) do not interfere with the determination. Large amounts of K may be removed by pretreatment with $HClO_4$. J. W. S.

Rapid micro-determination of silver by a method based on colloid colorimetry. C. G. Makris and R. Menaché (Ann. Chim. Analyt., 1940, [iii], **22**, 117—120).—The solution containing Ag is evaporated to dryness and the residue dissolved in H_2O (2 c.c.). Fresh 0·5% tannin solution (4 c.c.), 0·1N-NaOH (0·18 c.c.), and aq. Na albuminate (2 drops) are added. After 5 min. the colour produced is compared colorimetrically with standards prepared at the same time and containing 0·25, 0·5, and 1·0 c.c. of 0·01N-$AgNO_3$. Colour comparison is facilitated by using filters containing an aq. solution of gentian-violet and methylene-blue. The Na albuminate is prepared by dissolving fresh egg-white (5 c.c.) in 0·1N-NaOH (100 c.c.). To determine Ag in galena, the sample (0·2—0·3 g.) is ground finely and treated with HNO_3. After evaporating twice to dryness the residue is treated with 10% K_2SO_4 (2 c.c.), H_2O (3 c.c.), and 95% EtOH (5 c.c.). The $PbSO_4$ is separated, washed with EtOH, and the solution and washings are evaporated, treated with H_2O (10 c.c.) and aq. NaOAc, filtered, and made up to 25 c.c. 2 c.c. of this solution are taken for the colorimetric test.
J. W. S.

Limits of identification of simple confirmatory tests. A. A. Benedetti-Pichler and J. R. Rachele (Ind. Eng. Chem. [Anal.], 1940, **12**, 233—241).—The ultimate limits of identification of the test for $Ba^{\cdot\cdot}$ by addition of SO_4'' and for $Fe^{\cdot\cdot\cdot}$ by the formation of Prussian-blue have been investigated. Using the micro-manipulators and micro-injection apparatus described, drops of 10^{-9}—10^{-11} ml. of test solution and reagents were deposited in a film of paraffin oil and examined microscopically. With a ×397 magnification and dark-field illumination, 10^{-14} g. of $Ba^{\cdot\cdot}$ from 10^{-9} ml. of 0·001% $BaCl_2$ always gave positive results. With the same magnification and transmitted light, the Prussian-blue test was positive with 4×10^{-13} g. of $Fe^{\cdot\cdot\cdot}$ in 4×10^{-11} ml. of test solution. These results agree with theoretical conclusions. Factors determining experimental limitations are discussed. Under the best practical conditions, limits of identification are determined mainly by the increase in solubility with a decrease in particle size of ppts., the inherent intensity of a coloration, and limits of microscopic visibility, with the concn. sensitivity of the test playing a decisive part. L. S. T.

Colorimetric micro-determination of magnesium. C. P. Sideris (Ind. Eng. Chem. [Anal.], 1940, **12**, 232—233).—Hoffmann's method (A., 1937, III, 165) has been modified by extracting the Fe^{III}-8-hydroxyquinoline compound with $CHCl_3$ and diluting to the required vol. with BuOH. Details of procedure and typical results for 0·1—1·0 mg. of Mg are recorded. The Al, Pb, Fe, Zn, Mn, and Cu are removed with 8-hydroxyquinoline before the $FeCl_3$ is added to the Mg salt. L. S. T.

8-Hydroxyquinoline as a reagent for the determination of magnesium, especially in carbonate and silicate rocks. (Miss) C. C. Miller and I. C. McLennan (J.C.S., 1940, 656—659).—To 100 ml. of solution (≡10—50 mg. of MgO) are added NH_4Cl 2 g. and *o*-cresolphthalein (0·02% in EtOH) 0·5 ml. After addition of 6N-NH_3 (2 ml. > the amount necessary to attain p_H 9·5) the solution is heated to 70—80° and, according as the amount of Mg is large or small, a 5% or 1% solution of 8-hydroxyquinoline (I) in AcOH (2N. and 0·4N. respectively) is very slowly added with stirring until pptn. is complete and the supernatant liquid is deep yellow. The ppt. is digested at 100° for 10 min., collected, washed with hot H_2O, and dried at 105° [(I)-free ppt.] or at 160° [(I)-contaminated ppt.] for a few hr. The method is applicable to the determination of Mg in rocks after removal of Ca (as oxalate), Al, Fe, Mn, and SiO_2. The method affords fair accuracy but the Mg pptn. is very susceptible to changes in conditions.
C. R. H.

Quantitative spectrochemical analysis by measurement of relative intensities. E. K. Jaycox and A. E. Ruehle (Ind. Eng. Chem. [Anal.], 1940, **12**, 195—196).—The method described combines flexibility of application with the improved precision resulting from modern photometric methods. Representative analyses in which an impurity in Pb, Al, Fe, Cu, Ni, or alkaline-earth oxide is determined with an accuracy of 5—10% are recorded.
L. S. T.

Determination of lead in "ethyl" petrol.—See B., 1940, 424.

Polarographic determination of small amounts of copper in aluminium.—See B., 1940, 455.

Assay of mercurial ointments.—See B., 1940, 491.

Determination of aluminium by photometric fluorescence measurement. C. E. White and C. S. Lowe (Ind. Eng. Chem. [Anal.], 1940, **12**, 229—231).—The intensity of fluorescence of the Al–morin reaction is measured by means of the Pulfrich or photo-electric photometer. The amounts of morin and EtOH, the temp., and p_H required to obtain max. intensity are defined. Details of procedure and typical results (accuracy ~3%) for 0·01—0·005 mg. of Al per ml. are recorded. Interference by certain anions and cations is discussed. L. S. T.

Determination of manganese, magnesium, and lead in aluminium alloys containing lead.—See B., 1940, 455.

Titrimetric determination of ferric oxide and alumina in soil extracts.—See B., 1940, 475.

Systematic utilisation of atomic groups in analytical chemistry. XI. Relation between

constitution and analytical properties. J. V. DUBSKÝ (Mikrochem., 1940, **28**, 145—172).—Mainly a review (cf. A., 1939, I, 40, 157, 217, 429, 430). The following is new. Pure $NH_2\cdot CS_2H$ gives red Ni, brown Cu, and green Co salts (cf. lit.). H_2CS_3 gives a red Ni salt, $+ 3NH_3$. $(NMe_2\cdot CS\cdot S)_2$ (I) gives *salts*, 3X,4CuCl·OH, m.p. 203°, 3X,3NiCl·OH, m.p. 139°, 3X,2CoO, m.p. 315—320°, and $3X,2Co(OH)_3$, m.p. 310—315°. $(NMe_2\cdot CS)_2S$ [prep. from (I) by KCN] gives *salts*, 3X,4CuCl·OH, m.p. 204°, and $3X,2Co(OH)_3$, m.p. 315°. $SH\cdot CH_2\cdot CO_2H$ gives a *salt*, $Cu^{I}S\cdot CH_2\cdot CO_2\cdot Cu^{II}\cdot OH$. $SH\cdot C(N\cdot OH)\cdot CO_2H$ gives *salts*, $Fe_3[S\cdot C(N\cdot OH)\cdot CO_2H]_3$, $SH\cdot C(N\cdot OH)\cdot CO_2Ba(OH)_2Ba\cdot O\cdot CO_2H, + H_2O$, and $OH\cdot Fe[S\cdot C(N\cdot OH)\cdot CO_2BaCl]_2,18H_2O$. Fission of oximino-ψ-thiohydantoin (II) by NH_3 leads to a *salt*, $[Fe(NH_3)_4S\cdot C(N\cdot OH)\cdot CO_2NH_4](OH)_2,4H_2O$, and by KOH to the *salt*, $[OH\cdot N{:}C(CO_2H)S]_2Fe(OH)_2Fe[OH\cdot N{:}C(CO_2H)S]_2,4H_2O$. (I) gives a simple N-*Ag* salt, but complex Ba and Ca diol-salts. 2-Thiohydantoin–$NO\cdot C_6H_4\cdot NHPh$ (A., 1939, I, 430) should read 2-thiohydantoin–$NPh_2\cdot NO$. Ag salts of $CS(NH\cdot NHPh)_2$ and $NPh<^{CO\cdot C:N\cdot NHPh}_{N=C\cdot CO_2H}$, a Cr_2 diol-salt of $NHPh\cdot CH_2\cdot CO_2H$, Hg salt of $NO\cdot NPh\cdot CO_2H$ (sensitivity 6·4 μg. at 1 : 4700), various salts of *o*-$CO_2H\cdot C_6H_4\cdot NH\cdot CH_2\cdot CO_2H$, gallocyanine, and carminic acid (cf. A., 1930, 182), and 1-thiolbenzthiazole are noted. Condensation of $NPh_2\cdot NO$ with 2-thiohydantoin to a *product*, m.p. >350° (complex *Ag* salt), and with rhodanine to a *product*, $+2COMe_2,H_2O$, m.p. ~50°, are described
R. S. C.

Conductometric analysis of chrome liquors.—See B., 1940, 441.

Rapid determination of chromic oxide in chrome tanning extracts.—See B., 1940, 472.

Application of pyrrole to detection of certain ions by drop reactions. R. L. DREMLIUK (J. Appl. Chem. Russ., 1940, **13**, 157—160).—When a drop each of solution, of 1% pyrrole in EtOH, and of 2N-HCl or conc. H_3PO_4 are placed on filter-paper, a blue or green coloration appears in presence of ≮ the following amounts of ions: $Au^{\cdots}$ 3, VO_3' 0·8, MoO_4'' 34, MnO_4' 10, Cr_2O_7'' 5, IO_3' 0·16, BrO_3' 40, IO_4' 5, NO_2' 18, $[PO_4,12MoO_3]'''$ 18 μg. In these conditions $Hg^{\cdot}$ (≮ 4 μg.) gives a ppt. of Hg, but no coloration.
R. T.

Determination of gold in auriferous material.—See B., 1940, 453.

Assay for platinum metals in ore concentrates.—See B., 1940, 453.

Heat control units. J. A. RIDDICK (Ind. Eng. Chem. [Anal.], 1940, **12**, 222—224).—Control panels of two or more autotransformers are described. The autotransformer permits precise adjustment of the jacket temp. of fractionating columns, and of the rate of boiling of solvents.
L. S. T.

High-temperature laboratory furnaces. M. PIRANI (J. Sci. Instr., 1940, **17**, 112—115).—A tube furnace comprises a tube prepared from finely ground commercial BeO with a winding of 0·8-mm. Mo wire, The tube and heater are enclosed in an Fe casing, packed with BeO slabs and Al_2O_3 tubes, through which H_2 is led. A second type of furnace utilises spiral filaments of 1-mm. W wire, supported at the ends by Mo rods which pass through holes in the limbs of U-shaped pieces of Zr silicate bricks, which, together with rectangular bricks of the same material, form the furnace lining. The furnaces described have been operated at 1950° and 1900°, respectively.
J. W. S.

Device for investigating volatile and liquid substances in the micro-m.p. apparatus. R. FISCHER (Mikrochem., 1940, **28**, 173—182).—The device enables m.p. and n to be determined.
R. S. C.

Windows for studying the optical properties of hydrogen fluoride gas. B. VODAR, R. FREYMANN, and YEOU TA (J. Chem. Physics, 1940, **8**, 349).—Using a Duroid window a wide and weak band near 0·93 μ. has been found for ~ 40% aq. HF solution. Org. glasses and CaF_2 are attacked by conc. HF solutions and by gaseous and liquid HF but white corundum is unattacked by the gas even at high temp. and shows no absorption bands between 1850 A. and 2·5 μ.
W. R. A.

Refractive index liquids. V. L. BOSAZZA (Amer. Min., 1940, **25**, 299—301; cf. A., 1934, 749).—Data for n of various kerosene (I) fractions are given. Only the best grades of (I) yielding distillates of fairly pleasant odour should be used. $1\text{-}C_{10}H_7Br\text{–}AsPhI_2$–kerosene fraction gives the best set of mixtures for n 1·44—1·85; these mixtures are stable.
L. S. T.

Systematic qualitative organic micro-analysis. Determination of the refractive index of liquids. H. K. ALBER and J. T. BRYANT (Ind. Eng. Chem. [Anal.], 1940, **12**, 305—307).—The micro-refractometer described consists of two small glass prisms of the same n cemented together in opposition in a small metal ring on a microscope slide. The ring is filled with the test liquid (~8 cu. mm.) and the double deviation of the light beam is measured with a microscope; it ∝ the difference in n between glass and liquid. Reference to a prepared calibration curve gives n directly. By use of two cells, one with prisms n 1·52 and the other n 1·75, the range n 1·33—2·0 may be covered with a precision of ±0·001. The test liquid may be recovered.
J. D. R.

Increase of light intensity in optical apparatus. A. SMAKULA (Z. Instrumkde., 1940, **60**, 33—36; cf. Blodgett, A., 1939, I, 238).—Reflexion of light at glass–air surfaces can be eliminated by the deposition on the surface of a thin film of $n = \sqrt{n_g}$, and thickness $x\lambda/4(n_g^2 - \sin^2 \alpha)^{\frac{1}{2}}$ (n_g, refractive index of glass; x, an integer; λ, wave-length of incident light; α, angle of incidence of light).
O. D. S.

Lumino-microscopic methods. A. A. SCHISCHLOVSKI (Mém. Physique, Kiev, 1940, **8**, 155—159).—A fluoro-phosphoroscope is described.
R. T.

Recording microphotometer. H. LLOYD and E. M. GUÉNAULT (J. Sci. Instr., 1940, **17**, 103—111).—In the instrument described, the plate or film under examination rests on a moving horizontal stage

driven by a governor-controlled clock and coupled to a recording drum. The optical system is vertical and employs a photo-electric cell connected directly to a taut-suspension reflecting galvanometer, the deflexions of which are recorded photographically on the revolving drum. The instrument has been used for the measurement of spectroscopic and X-ray diffraction negatives, and as a recorder in the survey of low illuminations by photographic photometry.
J. W. S.

Neutral wedge abridged spectrophotometer. P. A. CLIFFORD and B. A. BRICE (Ind. Eng. Chem. [Anal.], 1940, **12**, 218—222).—An improved form of spectrophotometer (cf. A., 1936, 443), and monochromatic filters are described. The use of the instrument for determining the concn. of coloured solutions by reference to standard curves is detailed, and various applications are mentioned. L. S. T.

Thermionic relay. H. M. WADDLE and W. SAEMAN (Ind. Eng. Chem. [Anal.], 1940, **12**, 225).—The relay described can be used with any apparatus in which the current in the control circuits must be kept low in order to avoid sparking or corrosion of electrical contacts. L. S. T.

Coincidence counting in a β-particle spectrograph. N. FEATHER (Proc. Camb. Phil. Soc., 1940, **36**, 224—235).—The β-particle spectrograph described embodies a counting circuit designed to record coincidences between electrons of a fixed energy and particles of widely varying energy, with a resolving time 10^{-6} sec. The possibility of using such an instrument to investigate the correlation between the natural β-ray lines of a source and portions of the continuous spectrum corresponding with different modes of transformation is examined.
L. J. J.

Demonstration of thermal diffusion in liquids. D. TAYLOR and M. RITCHIE (Nature, 1940, **145**, 670).—Apparatus for demonstrating the Clusius–Dickel thermal diffusion effect (A., 1939, I, 224) in aq. $CuSO_4$, aq. $CuBr_2$, or acid (HCl) $CoCl_2$ is described. L. S. T.

Thermal diffusion separation of different gases of the same mol. wt. F. T. WALL and C. E. HOLLEY, jun. (J. Chem. Physics, 1940, **8**, 348).—Using a 9-ft. thermal diffusion column (described), separation of the components of the following mixed gases has been effected: CO_2–C_3H_8; CO_2–N_2O; CO–C_2H_4; N_2–C_2H_4. No separation occurred with CO–N_2 mixtures. Since separation occurs other factors, *e.g.*, structure and forces of attraction and repulsion, must influence the diffusion process as well as thermal effects. Usually the larger mols. are conc. at the bottom of the column. W. R. A.

Efficiency of the thermal diffusion process for separating isotopes. J. W. WESTHAVER and A. K. BREWER (J. Chem. Physics, 1940, **8**, 314—316).—Mathematical. The theory of Gillespie (A., 1939, I, 463) is extended to include other factors in the separation process. An ideal system of cells having temp. limits of 3000° and 500° K. requires $\nless$880 kw.-hr. of conducted heat per g. of $^{13}CH_4$ extracted to a concn. of 20%. W. R. A.

Deposition of thin metallic films by cathodic sputtering. V. VOSS and M. N. S. IMMELMAN (J. Sci. Instr., 1940, **17**, 116). A strip of Al foil, fitted around the inside of the shoulder of the bell-jar, and a horizontal disc of the metal to be sputtered carried on a glass-covered Al wire fitted axially through the top of the jar, are used as electrodes. The plate on which the film is to be sputtered is placed below the disc and out of the path of the discharge. J. W. S.

Self-seating valve. J. H. MARVELL (J. Sci. Instr., 1940, **17**, 115—116).—The valve comprises a screwed spindle with a very fine thread, carrying at its lower end a hardened stainless steel ball fitting into a suitably bored seating. This seating is made with a sharp edge so that the ball moulds it when first screwed down. The valve requires very little attention and has been used for high vac. and for pressures $\ngtr$120 atm. J. W. S.

Flow meter for slow rates of flow. A. E. L. MARSH (Trans. Faraday Soc., 1940, **36**, 626).—The instrument described measures (gas) flow rates ~1—0·25 c.c. per min., and the readings are independent of the η of the gas. F. L. U.

Simple manometer for the measurement of total pressure. C. WEISS and H. WESTMEYER (Z. Instrumkde., 1940, **60**, 53—54).—A hot-wire manometer, with temp. measurement by a thermocouple, for pressures down to 10^{-5} mm. is described.
O. D. S.

Accelerated sublimation. A. J. BAILEY (Ind. Eng. Chem. [Anal.], 1940, **12**, 194—195).—Cold air is passed through a heated flask (+ substance) fitted with a simple distillation head. The method is quicker and more convenient than ordinary or vac. distillation. β-$C_{10}H_7$·OH sublimed at the rate of ~1 g. per min. to give a pure product. L. S. T.

Removal of adhered rubber stoppers. F. A. ROBINSON (Ind. Eng. Chem. [Anal.], 1940, **12**, 224; cf. A., 1940, I, 176).—The glass rod is separated by means of a lubricated cork borer. L. S. T.

Apparatus for continuous automatic measurement of evolved gas. M. L. CROSSLEY, R. H. KIENLE, and C. H. BENBROOK (Ind. Eng. Chem. [Anal.], 1940, **12**, 216—217).—Apparatus for recording N_2 evolved from the decomp. of diazo-compounds by solvents is described, and its use illustrated by reference to the decomp. of PhN_2Cl by H_2O at 35°. It can also be used to record the rate of sedimentation of suspensions, and to determine rates of distillation. L. S. T.

Modified form of the standard falling-sphere viscosimeter.—See B., 1940, 417.

Apparatus for rapid determination of carbon and sulphur in ferrous products.—See B., 1940, 451.

New method of gas analysis.—See B., 1940, 421.

Geochemistry.

Waters from the calcareous massif of the Ouarsenis (Algeria). L. Calembert (Compt. rend., 1940, **210**, 630—632).—Analyses of 15 subterranean waters are correlated with the tectonic character of the deposits. A. J. E. W.

Fluorine in the waters of the Chihina region. V. V. Danilova (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 230—231).—The F contents recorded for the rivers and lakes of this region show that the % F differs little from that of other rivers, and that enrichment from the fluorapatite is low. The ratio F/dry residue is high. L. S. T.

Fluorine in the underground waters of the Chibina region. I. N. Zavialov (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 232—233).—The F contents and p_H of surface and underground H_2O of the Bolshoy and Maly Vudyavr lakes are recorded. The surface H_2O generally contains less F and has a lower p_H. L. S. T.

Radium, vanadium, chromium, and molybdenum contents of the hot springs of Yunohanazawa and their seasonal variations. K. Kuroda (Bull. Chem. Soc. Japan, 1940, **15**, 65—70).—Analytical results are given. F. J. G.

Analysis of the meteorite "Saratov." L. S. Selivanov (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 389—392).—The non-magnetic fraction of a meteorite which fell in Saratov in 1918 contained SiO_2 44·83, FeO 14·46, and MgO 27·43%, with smaller amounts of Ti, Al, Cr, Ca, Mn, Na, K, P, and S. The magnetic fraction contained Fe 68·1, Ni 8·9, MgO 6·28, and SiO_2 10·53%, together with small amounts of other elements. J. W. S.

Magmatic gases. T. A. Jaggar (Amer. J. Sci., 1940, **238**, 313—353).—Chemical analyses of numerous samples of gases collected in vac. tubes from liquid lava from Kilauea, Hawaii, are recorded, and discussed in relation to quality, to volcanic as opposed to atm. gaseous constituents, etc. L. S. T.

Method for distinguishing quartz and untwinned felspar with the universal stage. D. J. Doeglas (Amer. Min., 1940, **25**, 286—296).—A rapid and trustworthy method for determining quartz and untwinned felspar in mineral grains or thin sections is described. L. S. T.

Felspars from the mica pegmatites of Nellore, Madras. N. Jayaraman (Proc. Indian Acad. Sci., 1940, **11, A**, 116—137).—A detailed account of work already noted (A., 1938, I, 644). W. R. A.

Propylitisation and related types of alteration on the Comstock Lode. R. Coats (Econ. Geol., 1940, **35**, 1—16).—The Comstock district shows three types of alteration of the original pyroxene-andesite; these are (i) deuteric, due probably to H_2O vapour present in the rock at the time of its crystallisation, (ii) propylitic, due probably to heated solutions given off by a later intrusive, and (iii) zeolitic, due probably to vein-forming agencies. The usual explanations of propylitisation, viz., dynamometamorphism, autohydration, and action of vein-forming solutions, are not applicable. L. S. T.

Pegmatites of the Spruce Pine district, N. Carolina. C. S. Maurice (Econ. Geol., 1940, **35**, 49—78).—Numerous pegmatites are classified and described. In general, plagioclase predominates over microcline and crystallised first. Much of the commercial mica is primary. Accessory minerals include compounds of Nb, U, and the rare earths. L. S. T.

Metamorphism and assimilation in the Wellington district, New South Wales. I. Hybridisation in the Wuuluman Creek intrusion. E. M. Basnett (J. Proc. Roy. Soc. New South Wales, 1939, **73**, 161—189).—Petrography is described and petrogenesis discussed. The Wuuluman Creek mass consists of two separate intrusive types; the younger, a keratophyre (I), has invaded an earlier mass of dolerite and produced zones of hybrid rocks. The mineralogical changes in the hybrid rocks are due to the introduction of sodic magma (I), followed by the injection of a (I) richer in K_2O. Chemical analyses are recorded. L. S. T.

Fluorescence spectrum and composition of scapolite. E. Iwase (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 58—64).—Investigation of the fluorescence spectra of scapolites from North Burgess (Ontario) and Grenville (Quebec) shows that U is probably the effective activator. There are, however, differences in the positions of the U bands according to locality. Scapolite may be supposed to be the result of isomorphous combination of meionite, $Ca_4Al_6Si_6O_{25}$ (I), and marialite, $Na_4Al_3Si_9O_{24}Cl$. Determinations of face angles, n, and d show that North Burgess scapolite contains between 36 and 42 mol.-% of (I), whilst Grenville scapolite contains 70 mol.-% of (I). The difference in composition explains the variation in position of the U bands. A. J. M.

Secondary mineralogical modifications in the phlogopite deposit at Volonandrongo (west of the central massif of Madagascar). A. Lacroix (Compt. rend., 1940, **210**, 425—429).—The deposits, which include phlogopite, diopside, dipyre, apatite, sphene, molybdenite, actinote, byssolite, tremolite, asbestos, albite, clinozoisite, tourmaline, and heulandite, are described in detail and their formation is compared with that of deposits in the extreme south of Madagascar (cf. A., 1940, I, 237). A. J. E. W.

Photo-luminescence of scheelites. M. Servigne (Compt. rend., 1940, **210**, 440—442).—The approx. Pr, Nd, Sm, Eu, Gd, Tb, Dy, and Er contents of 15 scheelites have been determined by the photo-luminescence method (cf. A., 1937, I, 328; 1939, I, 509). Unusually high Eu_2O_3 contents ($\sim$0·2%) are recorded for specimens from Forbes Reef (Swaziland), Salzburg, and Brazil. A. J. E. W.

Petrography of chromite-dolomite refractories. D. S. Beljankin and B. V. Ivanov (Bull. Acad. Sci. U.R.S.S., Cl. Sci. Tech., 1939, No. 9, 53—60).—Petrographic examination of these refractories has shown the complexity of the silicate component, which contains Cr in various stages of oxidation and Ca_2SiO_4. The solid solution of periclase contains Fe and Mn, but no Cr. R. C.

Zircon studies in the New Jersey Highlands. S. A. Tyler (Amer. J. Sci., 1940, **238**, 260—271).—The zircons occurring in the Franklin limestone, the gneisses, the pegmatite, and the Fe ores are described; they are mainly of the hyacinth variety. A younger granite in southeastern New York contains the malacon type. The variety of the zircon can be used to distinguish rocks of widely-separated age in this area. The relation of zircon to the origin of these rocks is discussed. L. S. T.

Fluorite in the ore-bearing regions of the Kara-Tau range. V. Galitzki (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 385—388).—Hydrothermal CaF_2 is widespread in the carbonate rocks of the Kara-Tau range, the content ranging from 0·06 to 0·9% J. W. S.

Problem of the carbonate-apatites. III. Carbonate-apatite from Magnet Cove, Arkansas. D. McConnell and J. W. Gruner (Amer. Min., 1940, **25**, 157—167; cf. A., 1939, I, 47).—Carbonate-apatite associated with fluorapatite (I) from this locality is described. It occurs as a replacement of (I), and is probably hydrothermal in origin. The different optical properties of carbonate-apatites cannot be accounted for in terms of contamination of (I) by $CaCO_3$. The conclusion that carbonate-apatites are to be explained by such contamination is not supported by other evidence. The mineral substance of teeth and bones should be regarded as a carbonate-hydroxyapatite or dahllite. L. S. T.

Paleozoic phosphorites of Armenia. G. I. Buschinski (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 237—239).—P_2O_5 contents of the rocks and phosphorites of the Sary-baba mountains and the western end of the Zindzhirlu range are recorded and discussed. L. S. T.

Weathering of jarosites. F. V. Tschuchrov (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 256—257).—At the commencement of weathering jarosites usually acquire a reddish colour which is attributed to a high [Fe_2O_3] in those solutions which impregnate the jarosites and cause instability and hydrolytic splitting as a result of which hydrogoethites, morphologically similar, are formed. W. R. A.

Factors of composition and porosity in lead-zinc replacements of metamorphosed limestone. J. S. Brown (Amer. Inst. Min. Met. Eng., Tech. Publ., 1940, No. 1194, 14 pp.; Min. Tech., 1940, **4**, No. 2).—Pure limestone is generally resistant to ore replacement, but the reason is not necessarily connected with porosity; intensely silicated rock is also unfavourable to replacement. The best condition for this to occur is for the rock to consist of an intimate (1 : 1) mixture of silicates and $CaCO_3$, but no correlation has been detected between the tendency to replacement and the porosity of the rock. A. R. P.

Vaucluse gold mine, Orange Co., Virginia. C. E. Bass (Econ. Geol., 1940, **35**, 79—91).—History, production, and mining methods are described. The host rock is a quartz–sericite–chlorite schist. Pyrite is the only abundant sulphide, and contains most of the Au, which is the only valuable mineral recovered, and is of high purity. L. S. T.

Coal metamorphism in the Anthracite–Crested Butte Quadrangles, Colorado. E. C. Dapples (Econ. Geol., 1940, **35**, 109).—A correction (cf. A., 1939, I, 588). L. S. T.

Correlation of the Satpukuria seam in the Raniganj coalfield. M. M. Mukherji (Trans. Min. Geol. Met. Inst. India, 1939, **35**, 313—328).—Evidence that this seam is identical with the Ghusick seam is put forward. L. S. T.

Absorbing complex of soil. Paragenetic system of (colloidal) minerals. I. D. Sedletzki (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 258—262).—From previous data, it is concluded that a natural paragenetic association of minerals, distributed regularly over genetic horizons, corresponds with every soil, the minerals of the absorbing soil complex being composed of minerals formed under conditions of modern soil-formation. The properties of the absorbing complex vary with the character of mineral association. W. R. A.

Lime-secreting algæ and algal limestones from the Pennsylvanian of Central Colorado. J. H. Johnson (Bull. Geol. Soc. Amer., 1940, **51**, 571—595).—Algæ of CaO-secreting habit were present in considerable nos. during the Pennsylvanian, and contributed much calcareous material to the deposits. Chemical analyses of eight types are recorded. L. S. T.

Significance of limestones in the process of formation of ore bodies of the scarn type. K. A. Vlassov (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 222—225).—The part played by $CaCO_3$ in the development of ore bodies in various deposits of the U.S.S.R. is discussed. L. S. T.

***X*-Ray study of aragonite in natural and cultured pearls.** A. E. Alexander (Amer. J. Sci., 1940, **238**, 366—371).—*X*-Ray diffraction patterns of six representative pearls are reproduced, and correlated with microscopical examination. The powder diagrams of a natural crystal of aragonite from Biln, Bohemia, and a natural Oriental salt-water pearl are identical; little, if any, amorphous material is present. L. S. T.

Silver, lead, and zinc deposits of Manchuria. T. Ogura (Mem. Ryojun Coll. Eng., 1939, **12**, 205—242).—Ten mines are in operation and yield ~4000 tons of Pb, Ag, and Zn sulphide concentrates per month. The richer ore deposits occur mainly in limestone, granite, or gneiss. Primary ore minerals are galena (0·10—0·29% Ag) and sphalerite. Small amounts of chalcopyrite, argentite, molybdenite, arsenopyrite, and a few other sulphides occur. $ZnCO_3$ is absent. Oxidation in the Pb and Zn ores is not unusual. The Ag, Pb, and Zn deposits of Manchuria are classified into (i) fissure fillings (90%), (ii) contact, and (iii) metasomatic deposits. Origin and paragenesis are discussed. L. S. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

AUGUST, 1940.

X-Rays emitted by rarefied gases excited by an electric discharge. L. Groven (Bull. Acad. roy. Belg., 1939, [v], **25**, 329—333).—Vapours of Hg, I, and S excited by a discharge with exterior electrodes emitted *X*-rays of λλ 5·7, 2·9, and 5·2 A. in the *M*, *L*, and *K* spectra, respectively. The hardness is independent of the pressure but the intensity is a max. at a characteristic pressure; λ is independent of the diameter of the tube and of the exciting λ (7—35 m.). N. M. B.

***K* Absorption edges of Br (35) and Kr (36).** C. H. Shaw (Physical Rev., 1940, [ii], **57**, 877—881). —The absorption of monochromatic *X*-rays as a function of λ was measured for gaseous Kr, Br_2, and HBr in the region of the absorption edges. The structure for Kr is considerably different from that previously obtained for A (cf. Parratt, A., 1939, I, 543). The data for Br_2 and HBr are used to check the Kronig–Petersen theory (cf. following abstract). N. M. B.

Fine structure of the *X*-ray absorption limits of bromine and chlorine. T. M. Snyder and C. H. Shaw (Physical Rev., 1940, [ii], **57**, 881—886; cf. preceding abstract).—The ratio of the absorption coeff. of the Br atom in Br_2 to that in HBr for monochromatic *X*-rays is calc. by Petersen's theory as a function of the *X*-ray λ in the region of the *K* absorption edge. A predicted min. at ~5·9 v. on the high-frequency side of the edge agrees with experiment in position but not in intensity; a predicted broad max. at ~15 v. from the edge is not found. The structure for Cl is re-calc. from the Hartree self-consistent field and compared with photographic measurements. N. M. B.

Structure of the *L* absorption of sodium and its halides. H. M. O'Bryan (Physical Rev., 1940, [ii], **57**, 995—997).—The structure of soft *X*-ray absorption of thin films of Na, NaF, NaCl, NaBr, and NaI, photographed in the region 250—430 A. with a plane-grating vac. spectrograph of 0·1 e.v. resolving power, is much narrower and more complicated than in the corresponding *K* absorption spectra. The halides have narrow intense absorption "lines" near 380 A. towards shorter λλ, with widths at half-max. intensity as small as 0·3 e.v. and almost the same λ as the emission of Na II in the vac. spark. Na has a sharp edge at 405 A. and relatively faint structure at shorter λλ. Continuous absorption in the halides starts near 45 e.v. and is probably due to transitions to the conduction states of the crystal lattice. The similarity to the ionisation potential of the free ion at 47 e.v. indicates a highly ionic character of the halides and little broadening and displacement by neighbouring ions in the crystals. N. M. B.

Fine structure of the Stark effect in the H_β line. W. Steubing and A. Keil (Z. Physik, 1940, **115**, 150—178).—A calculation of the effect by Schlapp's method (A., 1928, 806) shows that dissymmetry should be observed in the profile of the H_β line with field strengths of 10^4—10^5 kv. per cm. This is verified by measurements on new high-dispersion spectrograms. A small displacement of the whole profile, which varies with the field strength, is also noted. A. J. E. W.

Forbidden atomic transitions in the spectra of the aurora and of the night sky. M. Nicolet (Bull. Acad. roy. Belg., 1939, [v], **25**, 81—86; cf. Vegard, A., 1939, I, 347).—A discussion of available data indicates that the apparent relations between the auroral or night-sky radiations and the forbidden transitions of O II, O III, and N II do not establish the existence of these ionised atoms in the upper atm. Confirmation is found of λλ 5577, 6300, and 6364 of O I, and of the identification of λ 3466·5 A. in the auroral spectra with the ^4S—^2P transition of N I. N. M. B.

Arc spectrum of silver. A. G. Shenstone (Physical Rev., 1940, [ii], **57**, 894—898).—In view of unsatisfactory available analyses, measurements were made with special types of arc, using a three-prism glass spectrograph for λ 10,000—5000, a quartz spectrograph for λ 5000—2100, and a 30,000-line 2-m. vac. spectrograph for λ 2100—1250. Full data and classifications for 243 lines (including 148 new lines), and vals. and identifications of levels, are tabulated. Term vals. and peculiarities of the spectrum are discussed in detail. N. M. B.

Effect of pressure on the wave-lengths of the international secondary standards in the first spectrum of iron. C. J. Humphreys (J. Res. Nat. Bur. Stand., 1940, **24**, 389—393).—The λλ of the lines of the Fe I spectrum from an Fe arc in air, adopted as secondary λ standards, are compared with the vals. observed by Burns and Walters for a vac. arc source (A., 1930, 2). The term depressions accord with the vals. observed by Babcock (Astrophys. J., 1928, **67**, 240). J. W. S.

Interaction of atomic energy levels. III. T. S. Subbaraya, K. Seshadri, and N. A. N. Rao (Current Sci., 1940, **9**, 173—175).—In continuation of previous work (A., 1940, I, 88, 241) mixtures of Cd and Zn have been investigated. Alterations in intensity of Cd and Zn lines due to admixture are recorded and discussed. W. R. A.

Zeeman effect in the xenon spark spectrum, Xe II. II. H. Angenetter (Z. Physik, 1940, **115**, 309—320; cf. *ibid.*, 1939, **114**, 636).—Measurements on

50 more lines (6990·88—4037·59 A.) are recorded. Humphreys' analysis (A., 1939, I, 166) is completely confirmed, and g-factors are calc. for 59 terms. The g-sum law is not obeyed in some cases, probably owing to interaction of adjacent states.

A. J. E. W.

Mutual interaction of plasma electrons. W. R. Haseltine (J. Math. Phys. Mass. Inst. Tech., 1939, **18**, 174—201).—Mathematical. Some processes occurring in a simplified model of the plasma or positive-column region of an electrical discharge through a gas at low pressure are considered, with special reference to the mutual interaction of the electrons and its effect on velocity distribution.

A. J. M.

Metastable atoms and decrease in breakdown potential in rare gases. W. Rogowski (Z. Physik, 1940, **115**, 257—295).—A detailed account of work reported previously (A., 1939, I, 302; 1940, I, 97). The application and extension of theories due to Townsend and others are discussed. A. J. E. W.

Positive-point to plane discharge in air at atmospheric pressure. A. F. Kip (Physical Rev., 1938, [ii], **53**, 210).—Current–voltage characteristics are described. L. S. T.

Collisions between gaseous molecules and slow electrons. L. A. M. Henry (Bull. Acad. roy. Belg., 1939, [v], **25**, 256—268).—An improved technique and apparatus are described. The gas in the form of a mol. jet enters the metal reaction chamber evacuated to $\sim 10^{-6}$ mm. and undergoes collisions with a jet of electrons from an indirectly heated oxide cathode. The radiation due to the transition of the excited mols. to the normal state is recorded by a photo-electric counter, and the ions formed are captured by a grid connected with an electrometer. N. M. B.

Measurements of discharge characteristics of Geiger–Müller counters. W. E. Ramsey (Physical Rev., 1940, [ii], **57**, 1022—1029; cf. A., 1939, I, 594).—An experimental method is presented for determining directly the voltage–time relationship (for $t = 2 \times 10^{-7}$—1×10^{-4} sec. and v. = 20—350) of a counter wire from the initiation of the discharge to the attainment of the max. negative potential of the wire. Observations are satisfactorily represented by $E = -(Q/c)\log_{10}(t/t_0 + 1)$, where E = the potential of the wire, Q = a function of cylinder voltage, and t_0 = a const. for a given counter. Modifications for the case where the counter "overshoots" (the voltage pulse $E_{max.}$ from the counter > the difference between starting potential and cylinder potential) are examined. Discharge characteristics were measured for a series of pressures of an A–O_2 mixture and results satisfy the logarithmic relation. An A–EtOH-filled self-quenching counter has characteristics of the same form. N. M. B.

Discharge mechanism of Geiger–Müller counters. C. G. Montgomery and D. D. Montgomery (Physical Rev., 1940, [ii], **57**, 1030—1040; cf. A., 1939, I, 594).—Ramsey's measurements (see preceding abstract) are interpreted on the basis of the inductive action of the positive-ion space charge moving across the counter, and this action, with the hypothesis that the positive ions may eject electrons when they reach the cathode, explains both the fast and slow types of breakdown of counters. This mechanism simply explains the quenching of a counter discharge and the necessary conditions for the maintenance of a steady discharge. It is predicted and verified that a counter can be operated even when the potential is $\gg$ that required for a continuous discharge, if the capacity of the counter wire is sufficiently reduced. A simple indirect method for measuring the breakdown characteristic of a counter is described, and results accord with the direct determinations. N. M. B.

Mechanism of nuclear isomeride separation process. G. T. Seaborg, G. Friedlaender, and J. W. Kennedy (J. Amer. Chem. Soc., 1940, **62**, 1309—1310).—Isomeric transition of ^{127}Te and of ^{129}Te from their upper to lower states brings about complete reduction of telluric to tellurous acid. Since small recoil energies are associated with these isomeric transitions, it appears unlikely that the recoil energies cause bond rupture and activation. It is suggested that the reduction is caused by the high state of electronic excitation which results from the vacancy in the K or L shell created by the emission of the internal conversion electron. This view is supported by the fact that isomeric transitions are obtained with $^{127}TeEt_2$ and $^{129}TeEt_2$ but not with $^{69}ZnEt_2$ at 110°, although the recoil energy of Zn is $\sim$5 times that of Te. W. R. A.

Neutrons from boron plus deuterons. H. Staub and W. E. Stephens (Physical Rev., 1938, [ii], **53**, 212).—Measurement of the energy distribution of neutrons from the disintegration of B with 1-Me.v. deuterons by the method of α-recoils in a He-filled high-pressure cloud chamber gives a curve similar to that of Bonner and Brubaker (A., 1936, 1174). Preliminary vals. of disintegration energies are recorded. The relative intensities are $\sim 1:2:1:3$.

L. S. T.

Disintegration of nitrogen by neutrons. Further experiments in a low-pressure cloud chamber. F. N. D. Kurie and M. Kamen (Physical Rev., 1938, [ii], **53**, 212).—Owing to various limitations, the method described can examine this disintegration in no greater detail than is already available. L. S. T.

Maximum geological age and some consequences of the hypothesis of Wilkins. II. β-Activity of ^{176}Lu and its spectrochemical sensitivity. J. M. López de Azcona (Anal. Fís. Quím., 1939, **35**, 7—11).—From Wilkins' supposition that originally U-I and Ac-U were in radioactive equilibrium, it is concluded that the greatest geological age is $3·75 \times 10^9$ years. Assuming a radiogenic origin for common Pb, it is calc. from its isotope ratio that the differentiation occurred at $0·182 \times 10^9$ years. Calculations are made for the equilibrium between Th and U. It is suggested that the radioactivity of Lu is due to $^{176}Lu \longrightarrow {}^{176}Hf + \beta$.

F. R. G.

Probability of pair production in nitrogen by γ-rays. L. V. Groschev (Compt. rend. Acad. Sci.

U.R.S.S., 1940, **26**, 419—423; cf. A., 1939, I, 115).—From extensions of the work previously recorded it is deduced that the effective cross-section for the process of pair production in N_2 is $0{\cdot}9 \times 10^{-26}$ sq. cm. Comparison of this val. with that for pair production in Kr supports the view that the effective cross-section $\propto Z^2$. The excess of the mean energy of positrons over that of electrons is > that predicted from the val. for Pb (A., 1936, 400). J. W. S.

Angular distribution and nuclear impulse for pairs in nitrogen. L. V. Groschev (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 424—428).—The mean angles made by the direction of the photon with the directions of emission of the positron and electron are equal (23°), whilst the mean angle between the directions of emission of the positron and electron is 40°. These vals. and the angular distribution are in accord with theory. J. W. S.

Presence of element 85 among disintegration products of radon. H. Hulubei and (Mlle.) Y. Cauchois (Compt. rend., 1940, **210**, 696—697).—Priority is claimed for the observation of lines ascribed to element 85 in the *X*-ray spectrum of disintegration products of Rn (cf. A., 1939, I, 440; Minder, Helv. Phys. Acta, 1940, **13**, 144). A. J. E. W.

Resonance scattering of neutrons in helium. H. Staub and H. Tatel (Physical Rev., 1940, [ii], **57**, 936; cf. A., 1939, I, 171).—Using a continuous 0·6—2·0-Me.v. neutron spectrum, the resonance arising from the existence of a virtual *P* level of ^{5}He was investigated. Measurements of the shape of the resonance curve indicate that the level of ^{5}He has a width at half-max. of 0·4 Me.v. The shape of the resonance peak of the scattering cross-section curve indicates a doublet structure of the two levels $J = \frac{3}{2}$ and $J = \frac{1}{2}$ with a splitting of $0{\cdot}24 \pm 0{\cdot}1$ Me.v.; the doublet is inverted. The $\frac{3}{2}$ level is unstable against decay into a neutron and an α-particle by 0·76 Me.v. and the $\frac{1}{2}$ level by 1·0 Me.v. N. M. B.

Missing heavy nuclei. L. A. Turner (Physical Rev., 1940, [ii], **57**, 950—957; cf. A., 1940, I, 142).—Considerations of the regularities in the distribution of isotopes indicate that Rn, Ac-*A*, Th-*A*, and Ra-*A* should be somewhat β-active but the branching ratios would be too small for detection of the activity except for Rn and Ra-*A*; $^{239}_{93}$ekaRe should be β-active with half-life ~1 month, $^{237}_{93}$ekaRe should be an α-emitting nucleus, and $^{237}_{92}$U should be β-active; the heaviest β-stable isotopes of transuranic elements should be $^{237}_{93}$ekaRe, $^{244}_{94}$ekaOs, $^{243}_{95}$ekaIr, and $^{250}_{96}$ekaPt. Isotopes of transuranic elements should undergo fission on exposure to slow neutrons; this and their presumably greater probability may account for their absence in nature. The relative abundance of ^{235}U and ^{238}U is in fair agreement with the hypothesis that the amount of ^{235}U was determined by a balance between production from ^{239}U and loss by fission. The probable chain of disintegration of $4n + 1$ nuclei is discussed; the estimated short half-lives and absence of a possible long-lived transuranic ancestor explain their non-survival. Hypothetical irradiation by neutrons or spontaneous fission of a transuranic ancestor will account for the low abundance of ^{209}Bi. N. M. B.

Products of uranium fission. Radioactive isotopes of iodine and xenon. R. W. Dodson and R. D. Fowler (Physical Rev., 1940, [ii], **57**, 966—971; cf. A., 1939, I, 350).—Decay curves of U-fission activities confirm available data (cf. Abelson, *ibid.*, 504) and establish the following active fission products: $^{>131}$I (6·6 hr.) → $^{>131}$Xe (9·5 hr.) → Cs (?); $^{>131}$Xe (4·3 days) → Cs (?) The 4·3-day Xe is produced by decay of 22-hr. I. The 6·6-hr. I is either a direct fission product or the product of an active Te of half-life < 1 min. N. M. B.

Anomalous scattering of neutrons by helium and the *d–d* neutron spectrum. E. Hudspeth and H. Dunlap (Physical Rev., 1940, [ii], **57**, 971—975).—A study of the variation ratio of the cross-section for scattering by He and H of neutrons from a *d–d* source partly surrounded by 3 cm. of paraffin shows the anomalously high cross-section in He at 1·0 Me.v. (cf. Staub, A., 1939, I, 171), and a He–H cross-section ratio diminishing to ~ half this max. at 1·4 Me.v., with no other max. The *d–d* neutron spectrum, investigated by He recoils, appears to be homogeneous, with no evidence for a low-energy neutron group of intensity as great as 1% of that of the main group. This indicates that ^{3}He is not formed in an excited state. N. M. B.

Interference phenomena in the scattering of slow neutrons. H. G. Beyer and M. D. Whitaker (Physical Rev., 1940, [ii], **57**, 976—981; cf. A., 1939, I, 396).—Transmission measurements of C neutrons (neutrons absorbed by Cd) show that the total cross-sections for various elements depend markedly on the physical and chemical states of these elements; this is indicated by the transparency of single crystals as compared with the polycryst. form, and by the non-additivity of cross-sections for compounds and alloys. The de Broglie λ of the C neutrons accords with an interference interpretation of these effects. Data for SiO_2, permalloy, and compounds of Fe, Ni, Mn, Cu, Zn, and the free elements are reported. N. M. B.

Radioactive isotopes of indium. J. L. Lawson and J. M. Cork (Physical Rev., 1940, [ii], **57**, 982—994; cf. A., 1939, I, 546).—Identifications, half-lives, radiations, and formation reactions for 10 radioactive In isotopes are tabulated and discussed in detail. Mass nos. and half-lives are: 116 (13 sec. and 54 min.), 114 (50 days and 72 sec.), 112 (65 hr.), 117 (117 min.), 113 (105 min.), 115 (4·5 hr.), 111 (23 min.), and 110 (66 min.). Assignments were effected by production with different excitation methods and measurement of energies of emitted β- and γ-radiations. Elements in which internally converted γ-rays are emitted are identified by observation of the differences in the *K*-, *L*-, and *M*-conversion electron energies and comparison with known binding energies from *X*-ray analysis. The β-spectrum of ^{114}In (50 days) is observed (an allowed transition) and on comparison with β-decay theory, previously tested by measurements on forbidden spectra, agrees with the predictions of the Fermi theory. N. M. B.

Neutron–proton interaction. H. B. HANSTEIN (Physical Rev., 1940, [ii], 57, 1045).—Investigations of the neutron–proton cross-section for In-resonance neutrons (energy ~1 e.v.) and for neutrons absorbed in Cd, under improved geometrical conditions, were made by means of transmission measurements in $C_{16}H_{34}$ by the resonance filter method. The val. obtained for In-resonance neutrons is $21\pm1\times10^{-24}$ sq. cm., in good agreement with Cohen (cf. A., 1939, I, 172), and for thermal neutrons $49\cdot0\times10^{-24}$ sq. cm., in good agreement with available data (cf. Carroll, A., 1938, I, 593). N. M. B.

Cloud-chamber studies in the cyclotron magnetic field. L. W. ALVAREZ and W. M. BROBECK (Physical Rev., 1938, [ii], 53, 213). L. S. T.

Energy release from ^{9}Be (*d*, α) ^{7}Li and the production of $^{*7}Li$. (MISS) E. R. GRAVES (Physical Rev., 1940, [ii], 57, 855—862; cf. Williams, A., 1938, I, 7).—Investigations with a variable air pressure absorption cell, ionisation chamber, and linear amplifier show that the α-particles from ^{9}Be (*d*, α) ^{7}Li consist of two groups differing at 760 mm. and 15° by $3\cdot08\pm0\cdot10$ mm. range, reduced to zero bombarding voltage. They are associated with the production of ^{7}Li in the ground state and in an excited state, the latter formed, at 239 kv. bombarding voltage, 1·7 times as often as the former. The energy balance associated with the production of the ground state is $7\cdot093\pm0\cdot022$ Me.v. The energy of the excited level is 494 ± 16 ke.v., and this is discussed in connexion with vals. from other reactions in which ^{7}Li is an end-product and with γ-ray measurements of the level. The total yield curve for α-particles was investigated for 235—390 kv. bombarding voltage. N. M. B.

Ends of the mesotron tracks observed in an expansion chamber. A. MIGDAL and J. POMERANCHUK (Physical Rev., 1940, [ii], 57, 934).—Mathematical. A mesotron, after ceasing to produce appreciable ionisation, has sufficient energy to traverse by diffusion a certain distance from the end-point of the track (cf. Nishina, A., 1939, I, 292) before undergoing disintegration. The distribution probability and diffusion range are examined. N. M. B.

New type of nuclear reaction. R. SHERR (Physical Rev., 1940, [ii], 57, 937).—Experiments described show that the 33-min. period observed when S is bombarded with 0·1 μa. of 22-Me.v. He^{++} ions from a cyclotron is ^{34}Cl formed by the reactions ^{32}S (α, *d*) ^{34}Cl or ^{32}S (α, *pn*) ^{34}Cl. It can also be formed by ^{31}P (α, *p*) ^{34}Cl or ^{33}S (*d*, *n*) ^{34}Cl. Two very weak unidentified activities of 3·3 hr. and >8 days were observed, but there was no evidence of a 1·1 hr. period. N. M. B.

Production and half-life of ^{33}Cl. J. B. HOAG (Physical Rev., 1940, [ii], 57, 937).—The decay curve of high-purity S bombarded with 8-Me.v. deuterons in an atm. of He was analysed into a 2·5-min. component due to ^{32}S (*d*, α) ^{30}P and a 2·8-sec. component identified as arising from ^{32}S (*d*, *n*) ^{33}Cl. The 2·8-sec. period is therefore due to the decay of ^{33}Cl in the reaction $^{33}Cl \rightarrow {}^{33}S + e^{+}$. N. M. B.

Penetrating [cosmic] radiation under more than 300 metres water-equivalent. J. BARNÓTHY (Z. Physik, 1940, 115, 140—149).—Certain anomalies in coincidence counter measurements by the author (A., 1939, I, 351) and others are explained if the radiation at considerable depths consists of neutrons or neutrinos produced by decomp. of mesotrons, together with ionising secondaries which penetrate 20 cm. of Pb. A. J. E. W.

Hard component of cosmic radiation in the stratosphere. A. EHMERT (Z. Physik, 1940, 115, 326—332; cf. Schein, Jesse, and Wollan, A., 1939, I, 594).—The altitude variation of rays penetrating 9 cm. of Pb has been studied with triple coincidence counters attached to a balloon. At atm. pressures (*p*) >300 mm. the results conform to the absorption curve for normal *p*; the no. of coincidences increases in the range 300—100 mm., and is const. within the experimental error (10%) at *p* = 100—16 mm. The const. val. is 12·2 times the val. at sea level. A. J. E. W.

Decomposition probability of the mesotron. A. EHMERT (Z. Physik, 1940, 115, 333—338).—Measurements of the altitude effect for penetrating particles and of absorption in H_2O (cf. preceding abstract and A., 1937, I, 545) and Blackett's energy spectrum (*ibid.*, 390) are used to obtain decomp. data for the mesotron. No assumptions are made as to the height of origin, initial energy, or energy loss. If μ is the mass and τ the mean life period of the mesotron, $\mu c^2/\tau = (2\cdot1\pm0\cdot6)\times10^{13}$ ev. per sec.; if $\mu = 160m$, $\tau = (3\cdot7\pm1)\times10^{-6}$ sec. Previous determinations of τ from the barometer effect give concordant results if the particle energies are corr. A. J. E. W.

Asymptotic orbits in the theory of primary cosmic radiation. A. BAÑOS, jun. (J. Math. Phys. Mass. Inst. Tech., 1939, 18, 211—238; cf. A., 1939, I, 296).—Mathematical. The calculation of the motion of charged particles in the field of a magnetic dipole, which occurs in the Lemaître–Vallarta theory of the charged component of cosmic rays, is considered. In particular the calculation for a given parameter of a family of trajectories, asymptotic to a given symmetric, unstable, periodic orbit, is dealt with. A. J. M.

Intensity and rate of production of mesotrons in the stratosphere. M. SCHEIN, W. P. JESSE, and E. O. WOLLAN (Physical Rev., 1940, [ii], 57, 847—854; cf. A., 1940, I, 190).—Data are reported from balloon flights with a coincidence counter recording vertical mesotron intensity and also the no. of mesotrons produced in a 2-cm. Pb block by a non-ionising radiation. The absorption coeff. for mesotrons in the pressure range 8—50 cm. is $1\cdot2\times10^{-3}$ per g. per sq. cm. The production of mesotrons in the Pb block becomes noticeable at ~35 cm. pressure and increases with altitude at about the same rate as does the soft component, indicating that the photons are mainly responsible for the observed creation in the Pb. On this assumption the calc. cross-section for the process is $0\cdot7\times10^{-27}$ per sq. cm. per nuclear particle in Pb. N. M. B.

Magnetic storm effect on cosmic rays at high latitudes. D. H. LOUGHRIDGE and P. F. GAST (Physical Rev., 1940, [ii], 57, 938).—The beginning of a magnetic storm was accompanied by a sudden decrease in cosmic-ray intensity of ~2% at 58° N.

magnetic latitude. The normal and abnormal intensity–latitude curves are given. N. M. B.

Anomalous absorption of the hard component of cosmic rays in air. M. AGENO, G. BERNARDINI, N. B. CACCIAPUOTI, B. FERRETTI, and G. C. WICK (Physical Rev., 1940, [ii], **57**, 945—950; cf. Rossi, A., 1940, I, 5, 190).—The anomalously large absorption in air of mesotrons was confirmed, independently of the assumption of isotropic distribution of primary rays, by comparison of the vertical intensity of mesotrons at 500 and 3460 m., and of that at 3460 m. with the intensity under a zenith angle of 45°. Results interpreted on the hypothesis of mesotron instability are consistent with a mesotron proper lifetime of 4 or 5 μ-sec. N. M. B.

Direct evidence of a proton component of cosmic radiation. T. H. JOHNSON, J. G. BARRY, and R. P. SHUTT (Physical Rev., 1940, [ii], **57**, 1047—1048; cf. A., 1939, I, 506; 1940, I, 189).—Analysis under various assumptions of certain Wilson cloud-chamber tracks indicates that ~15% of the penetrating rays reaching the "slow" state are protons and that 1·5% of the fast cosmic rays can be protons. N. M. B.

Air mass effect on cosmic-ray intensity. Y. NISHINA, Y. SEKIDO, H. SIMAMURA, and H. ARAKAWA (Physical Rev., 1940, [ii], **57**, 1050—1051).—Analyses, similar to those reported by Loughridge (cf. A., 1940, I, 54), are given for cosmic-ray data obtained in Japan. A warm front produced a gradual decrease in cosmic rays; the cold front caused only statistical fluctuations. N. M. B.

Existence of mesotron showers. W. F. G. SWANN and W. E. RAMSEY (Physical Rev., 1940, [ii], **57**, 1051).—Further direct evidence of the existence of mesotron pairs is obtained from recent observations with an apparatus previously described (cf. A., 1940, I, 189). There is evidence of ~16 mesotron pairs per 10,000 events recorded. N. M. B.

Ionisation, negative ion formation, and recombination in the ionosphere. N. E. BRADBURY (Physical Rev., 1938, [ii], **53**, 210).—Ionisation in the ionosphere is discussed in the light of present theories of recombination and negative ion formation. L. S. T.

Relativistic spin–orbit coupling in nuclei. S. M. DANCOFF and P. MORRISON (Physical Rev., 1938, [ii], **53**, 211). L. S. T.

Production of pairs by fast electrons. W. E. LAMB, jun., and A. J. F. SIEGERT (Physical Rev., 1938, [ii], **53**, 211).—Theoretical. L. S. T.

Formation of matter. T. THAYER-OJEDA (Separate, Santiago de Chile, 1939, 3—56; cf. A., 1938, I, 55).—Empirical relations between d and at. wt. are deduced. F. R. G.

Sources of stellar energy. Criticism of the Bethe–Gamow theory. R. N. RAI (Indian J. Physics, 1940, **14**, 55—60).—Existing theories concerning the energy production in white dwarfs are reviewed. The low energy of production may arise from the existence of neutrons and high pressure due to the degenerate electron gas inside the white dwarfs. W. R. A.

Classical theory of spinning particles. H. J. BHABHA (Proc. Indian Acad. Sci., 1940, **11**, **A**, 247—267, 467).—Mathematical. Exact relativistic classical equations taking radiation reaction into account for the rotation and translation of a point dipole are given for the case where the dipole is always a pure magnetic dipole in the rest system. W. R. A.

Elementary heavy particles with any integral charge. H. J. BHABHA (Proc. Indian Acad. Sci., 1940, **11**, **A**, 347—368, 468).—Theoretical. Divergences in the quantum theory of the electron are attributed to the neglect of effects of radiation reaction. The interaction of the meson field (neutral and charged) with heavy particles is discussed. W. R. A.

Structure of the negative ion. Determination of the nuclear magnetic moment. T. V. IONESCU (Compt. rend., 1940, **210**, 699—701).—Theoretical. The vibrational $\nu\nu$ of gaseous negative ions (particularly that of H), which fall in the region of short and ultra-short electro-magnetic waves, are considered; the results are in agreement with experimental data [V. MAJERU]. A new method for the determination of nuclear moments follows from the theory. A. J. E. W.

Flint's five-dimensional theory of the electron. W. BAND (Phil. Mag., 1940, [vii], **29**, 548—552).—By a change of unit for the fifth co-ordinate, the fifth component of momentum is made equal to the spin momentum, and the spin is brought into relation with the de Broglie λ. L. J. J.

Internal scattering of γ-rays. E. P. COOPER and P. MORRISON (Physical Rev., 1940, [ii], **57**, 862—866).—Mathematical. The internal scattering of an electric dipole γ-ray by the s electrons of a radioactive atom, where the radiation field of the near-by nucleus can fulfil momentum conditions impossible for a plane wave, is considered. In agreement with experiment, the no. of internally scattered electrons is found to be inappreciable. N. M. B.

Oppenheimer–Phillips process. G. M. VOLKOFF (Physical Rev., 1940, [ii], **57**, 866—876).—Mathematical. An examination of the energy distribution of the outgoing protons in the process of neutron capture by heavy nuclei bombarded with deuterons (cf. Bethe, A., 1938, I, 112). N. M. B.

Field theories for charged particles of arbitrary spin. L. I. SCHIFF (Physical Rev., 1940, [ii], **57**, 903—905).—Mathematical. A class of field theories that are invariant under the complete Lorentz and gauge groups is discussed. N. M. B.

Effect of the Coulomb force on binding energies of light nuclei. W. E. STEPHENS (Physical Rev., 1940, [ii], **57**, 938—939).—Data are tabulated and discussed for experimental vals. and for vals. calc. on four different nuclear models of differences in binding energy between 12 pairs of isobaric light nuclei for which $Z = \frac{1}{2}A \pm \frac{1}{2}$. A "nuclear radius" defined from the formula of the Coulomb repulsion C of the extra proton and calc. from observed vals. of C is plotted as a function of A. The vals. for ^{9}B and ^{5}Li are anomalous. N. M. B.

Resonance scattering of α-particles. M. E. Rose (Physical Rev., 1940, [ii], **57**, 958—965).—The elastic scattering of α-particles by nuclei of zero spin is considered on the many-body theory. Procedures for determining resonance energies and the assignments of angular momenta are discussed and criticised. An alternative method is suggested for obtaining the angular momenta directly from measurements of the angular distribution of the scattering at fixed energies. A procedure, eliminating straggling of α-particles, for a more accurate determination of the energies and widths of resonance levels is given, the resonance energy and width depending only on readily measurable quantities. N. M. B.

Theory of meson decay. H. A. Bethe and L. W. Nordheim (Physical Rev., 1940, [ii], **57**, 998—1006; cf. A., 1940, I, 190).—Mathematical. A new derivation of the meson lifetime and of the β-decay formula according to Yukawa's theory is given. Quant. agreement for both meson decay and β-decay is not obtained, as adjustment of consts. to give observed lifetime for β-decay results in a meson lifetime of $\sim 10^{-8}$ sec. compared with $\sim 10^{-6}$ sec. from cosmic-ray observations. N. M. B.

"Surplus" terms in [spectra of] hydrides. B. Grundström (Z. Physik, 1940, **115**, 120—139).—"Surplus" terms of diat. hydride mols. such as InH, TlH, HgH, CaH, and SrH can be incorporated in a dissociation scheme by application of the mode of coupling designated by Mulliken "far nuclei case *c*," and the Wigner–Witmer rules; the ground state is obtained by a combination of the ground states of the free atoms. Certain other peculiarities of the above spectra and that of AlH can also be explained. A. J. E. W.

Structure of the 2916 A. band of OD and the mass ratio of the hydrogen isotopes. K. R. Rao and M. G. Sastry (Current Sci., 1940, **9**, 172—173).—Consts. for the 2916 A. (2,1) band of OD and vibrational energy levels for the upper $^2\Sigma^+$ state are given. The deduced ratio of H isotopes is 0·7282 (cf. 0·7281 calc. from isotopic masses of H and D). W. R. A.

Equilibrium between H_2O and D_2O. I. R. Rao and Y. P. Rao (Current Sci., 1940, **9**, 171—172).—The Raman spectra of pure H_2O, 99·4 at.-% D_2O, and their mixtures have been investigated. Pure H_2O gives a band extending from 2977 to 3817 cm.$^{-1}$ (max. 3443), whilst mixtures give a narrower band from 3080 to 3808 cm.$^{-1}$ (max. 3461). Pure D_2O gives a band 2194—2844 cm.$^{-1}$ (max. 2538 and 2400); mixture 2244—2810 cm.$^{-1}$ (max. 2523). Intensity distributions are markedly altered on admixture. W. R. A.

Origin of radio fade-outs and the absorption coefficient of gases for light of wave-length 1215·7 A. W. M. Preston (Physical Rev., 1940, [ii], **57**, 887—894).—In view of the suggestion that the ionisation in the *D* region of the ionosphere causing radio fade-outs is due to radiation of the first Lyman line of H at 1215·7 A. from solar eruptions, the accurate absorption coeffs. for this line were measured. The vals. obtained, O_2 0·28, N_2 $<$0·005, CO_2 2·01, and H_2O vapour 390 (all reduced to n.t.p.), indicate that although the line may penetrate to sufficiently low altitudes it is unlikely that it can produce ionisation and hence cause fade-outs. The possibility of these being due to higher Lyman series members or to *X*-rays of $\sim$2 A. is considered. N. M. B.

Pressure effect on infra-red absorption. J. Strong and K. Watanabe (Physical Rev., 1940, [ii], **57**, 1049).—A new method of determining the height of atm. O_3 depends on simultaneous measurement of the absorption of O_3 in the ultra-violet where the absorption is independent of pressure and in the infra-red at 9·6 μ. where it is pressure-dependent. Laboratory measurements of infra-red absorption for 6—104 mm. pressure (*P*) can be represented by $A = kP^{\frac{1}{2}}$, where $A = \%$ absorption and $k = 0{\cdot}174$. This equation satisfies data for CO_2 at 14·7 μ. N. M. B.

Extreme ultra-violet absorption spectra of simple hydrocarbons. E. P. Carr and H. Stücklen (Proc. VII Conf. Spectros., 1939, 128—133).—A summary of results of measurements down to 1600 A. of the absorption spectra of straight-chain and cyclic olefines (A., 1938, I, 173) and of $\Delta^{\alpha\gamma}$-pentadiene, ethylallene, and diallyl. O. D. S.

Detection and estimation of molecules in the stars. H. G. Howell (Proc. VII Conf. Spectros., 1939, 142—146).—A review. O. D. S.

Ultra-violet absorption spectra and formation of indole and indolenine derivatives.—See A., 1940, II, 288.

Ultra-violet absorption and chemical constitution of substituted carbamides and thiocarbamides. A. Clow and N. L. Helmrich (Trans. Faraday Soc., 1940, **36**, 685—696; cf. A., 1938, I, 233).—Absorption curves between λλ 4000 and 2200 of 35 derivatives of $CO(NH_2)_2$ and $CS(NH_2)_2$ have been determined and are correlated with their chemical constitutions as given by the diamagnetic susceptibilities. F. L. U.

Spectroscopic evidence for hydrogen bonds. Hexyl alcohols. I. S. C. Stanford and W. Gordy (J. Amer. Chem. Soc., 1940, **62**, 1247—1251).—The infra-red absorption spectra of hexan-α-, -β-, and -γ-ol, β-methylpentan-α-, -β- and -δ-ol, γ-methylpentan-α-ol, and β-ethylbutan-α-ol have been measured in the 3 μ. region for the pure liquids and for 0·291, 0·1, and 0·05M. solutions in CCl_4. From the location of the O–H bond and its behaviour on dilution, conclusions are drawn regarding the degree of association of the isomerides. W. R. A.

Photochemical studies. XXX. Fluorescence of diacetyl. General considerations governing the study of fluorescence. F. C. Henriques, jun., and W. A. Noyes, jun. (J. Amer. Chem. Soc. 1940, **62**, 1038—1043).—The effects of pressure, temp., λ, intensity, and added $COMe_2$ on the fluorescence of Ac_2 have been investigated. Ac_2 emits no measurable fluorescence when irradiated by 3130 or 2537 A. The quantum efficiency of the fluorescence emitted on excitation with 3650 A. increases with rising pressure from 4 to 50 mm., at first rapidly, then more slowly, and finally attains an almost const. max. val. The fluorescence decreases slightly with increased temp. from 15° to 60°; the fluorescence efficiency is inde-

pendent of the incident intensity. Addition of $COMe_2$ enhances the fluorescence except at very high pressures of $COMe_2$ when some apparent quenching sets in. A mechanism is advanced in which the state formed by absorption cannot fluoresce but changes into other (fluorescing) states by collision. At least three upper states appear to be involved. W. R. A.

Effect of low temperature on the intensity of fluorescence. J. E. DINGER and W. KUNERTH (Iowa State Coll. J. Sci., 1940, **14**, 195—198).—Using 2537 A. as exciting radiation, the intensities of fluorescence (*I*) of three commercial phosphors, CdB_2O_5, $ZnSiO_3$, and $CaWO_4$, at temp. between 20° and −183° have been measured. For $ZnSiO_3$ *I* remains approx. const. down to −90°, increases rapidly to a max. at −130°, and then falls. $CaWO_4$ behaves similarly, with a max. at −150°, whilst CdB_2O_5 remains const. down to −80° and then falls steadily. The three phosphors show a sharpening of the fluorescence band as temp. is lowered. W. R. A.

Splitting of spectral lines at scattering by liquids. S. M. MITRA (Indian J. Physics, 1940, **14**, 1—11).—The fine structure of the Rayleigh line due to the mol. scattering of C_6H_6, PhMe, CCl_4, CS_2, MeOH, PhCl, *cyclo*-hexane and -hexanol has been investigated by a Fabry–Perot etalon. Splitting was observed for each compound, first components alone being present; no higher components (cf. Gross, *e.g.*, A., 1932, 676, 722) nor red shifts (cf. Cabannes, A., 1930, 15) were observed. Vals. of $\Delta\nu$ were > those calc. from the Brillouin expression, $\Delta\nu = 2\,\nu_0(v/c)\sin\theta/2$, where v is the velocity of sound in the medium and θ the angle of scattering. $\Delta\nu$ increases (*a*) as ν_0 the frequency of the incident radiation increases, (*b*) as θ increases, (*c*) as the temp. is lowered. With decrease of temp. the Doppler components on each side of the central line become sharper and more intense, whilst the intensity of the central component decreases. All three components are completely polarised. W. R. A.

Dark current of a willemite crystal. R. C. HERMAN and R. HOFSTADTER (Physical Rev., 1940, [ii], **57**, 936).—In an investigation of photo-conductivity at low temp., the dark current showed a sudden large increase at $\sim -60°$, while the crystal was warming up with the field on, and then fell to its low initial val. The effect is obtained on ultra-violet illumination of the crystal (but not if this is depolarised) at low temp. with the field on and subsequent warming up in the dark. The effect is probably connected with the emission of trapped light (cf. Johnson, A., 1939, I, 355). N. M. B.

Deviations from Ohm's law at high current densities. E. GUTH and J. MAYERHÖFER (Physical Rev., 1940, [ii], **57**, 908—915).—Mathematical. The deviations are calc. on the basis of the wave-mechanical theory of conductivity. A c.d. of 10^9 amp. per sq. cm. causes a deviation of only 1%. N. M. B.

Dipole moments and structures of certain compounds of sulphur, selenium, and phosphorus. C. P. SMYTH, G. L. LEWIS, A. J. GROSSMAN, and F. B. JENNINGS (J. Amer. Chem. Soc., 1940, **62**, 1219—1223).—Vals. of μ in C_6H_6 at 25° are given: H_2S_2, 1·17; S_2Cl_2, 1·60; Se_2Cl_2, 2·1; $SeOCl_2$, 2·62; $POCl_3$, 2·40; $PSCl_3$, 1·41 D. H_2S_2 appears to have an extended structure, H–S–S–H, with a small proportion of branched mols., H_2S–S. S_2Cl_2 and Se_2Cl_2 appear to be a mixture of Cl–X–X–Cl and (predominantly) X–XCl_2 in the form of an irregular tetrahedron. $SeOCl_2$ is an irregular tetrahedron. Moments of the following linkings have been calc.: Se–O, 3·0; P^+–O^-, 3·5; P^+–S^-, 2·5 D. W. R. A.

Optical rotatory power of bromo- and iodo-aryl derivatives of stereoisomeric methylene-camphors.—See A., 1940, II, 255.

Periodic table. J. GUZMÁN (Anal. Fís. Quím., 1939, **35**, 104—106).—A graphical arrangement of the elements, with *Z* and their chemical properties (rare gases being zero) as co-ordinates. F. R. G.

Degeneracy in non-relativistic Bose–Einstein statistics. D. V. GOGATE and D. S. KOTHARI (Indian J. Physics, 1940, **14**, 21—36).—Mathematical. Direct proofs of the Maxwell–Boltzmann, Fermi–Dirac, and Bose–Einstein distribution laws are given. W. R. A.

[Interrelation of molecular constants for di-atomic molecules. II.] R. A. NEWING (Phil. Mag., 1940, [vii], **29**, 603; cf. A., 1940, I, 198).—A correction. L. J. J.

Hindered rotation in methyl alcohol. J. S. KOEHLER and D. M. DENNISON (Physical Rev., 1940, [ii], **57**, 1006—1021).—The problem is examined mathematically in relation to a model in which a rigid OH bar may rotate, under the action of a hindering potential, about the axis of a rigid pyramid representing the Me group. A qual. treatment of the behaviour of the energy levels as the potential barrier height is raised from zero to ∞ is given, and an exact method of calculating the energy levels, wave functions, and transition probabilities is devised. It is shown that the levels lying well below the barrier (vibrational levels) are each split into three components, the spread of which depends on the penetrability of the barrier. Levels lying above the barrier rapidly acquire the character of states found in free rotation. Calculations with a barrier height of 770 $cm.^{-1}$ give levels and a spectrum in qual. agreement with observational data, but the barrier height is probably $\sim 470 \pm 40$ $cm.^{-1}$ N. M. B.

Ferromagnetism, antiferromagnetism, and particle size. W. KLEMM (Z. Elektrochem., 1940, **46**, 296—297).—Discussion of the data of Haul and Schoon (cf. A., 1940, I, 13) leads to the view that although antiferromagnetism is possible with large well-formed crystallites (α-Fe_2O_3) as well as with small ill-formed crystallites (γ-Fe_2O_3), ferromagnetism can occur only when the crystallites are well formed and > a limiting size. C. R. H.

New *X*-ray effect. (SIR) C. V. RAMAN and P. NILAKANTAN (Current Sci., 1940, **9**, 165—167). W. R. A.

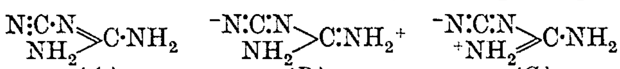
Crystallography of diamonds of the Brazilian type. I. I. SCHAFRANOVSKI (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 662—665).—Crystallographical data are given. F. J. G.

Secondary *K*-absorption edges of cobalt salts in solid and liquid solutions. B. B. Ray, S. R. Das, and N. Bagchi (Indian J. Physics, 1940, **14**, 37—54).—The primary and secondary *K*-absorption edges of solid Co, CoO, Co_2O_3, $CoSO_4,7H_2O$, $Co(NO_3)_2,6H_2O$, $CoCl_2,6H_2O$, $CoCl_2$, and $Co(NO_2)_2$; aq. solutions of $CoSO_4,7H_2O$ (1·7, 1·0, 0·1, 0·05N.), $CoCl_2,6H_2O$ (1·5, 1·0, 0·1, 0·05N.), and $Co(NO_3)_2,6H_2O$ (1·9, 0·64, 0·32N.); and a saturated solution of $Co(NO_3)_2,6H_2O$ in conc. HNO_3 have been measured. The primary *K*-edge is at longer λλ for Co than for compounds, but the secondary is similar in all solid compounds. The influences of crystal structure and dissolution are discussed. W. R. A.

Width of the *K*-absorption edge of cobalt. N. Bagchi (Indian J. Physics, 1940, **14**, 61—65; cf. preceding abstract).—The width of the *K*-absorption edge of Co is > that of solid compounds of Co examined (*loc. cit.*), whilst in solid compounds it is > for their aq. solutions. The width for $Co(NO_3)_2,6H_2O$ in conc. HNO_3 is > in H_2O > solid. The *K′* structure edge has been found for Co and Co_2O_3. W. R. A.

Crystal structure of sodium formate, HCO_2Na. W. H. Zachariasen (J. Amer. Chem. Soc., 1940, **62**, 1011—1013).—HCO_2Na recrystallised from H_2O as twinned crystals with (001) as twinning plane. It is slightly hygroscopic. The crystals are monoclinic, a_1 6·19±0·01, a_2 6·72±0·01, a_3 6·49±0·01 A., α_2 121° 42′±10′, 4 mols. per unit cell, space-group C_2/c (C^6_{2h}). Na, H, and C atoms are on twofold rotation axes, O atoms in general positions; parameter vals. are given. The two C–O bonds of the HCO_2 group are in complete resonance; C—O = 1·27 A. and the bond angle is 124°. Na has six O neighbours at an average distance of 2·44 A. W. R. A.

Crystal structure of dicyanodiamide. E. W. Hughes (J. Amer. Chem. Soc., 1940, **62**, 1258—1267).—The monoclinic unit cell of dicyanodiamide (I) has *a* 15·00, *b* 4·44, *c* 13·12 A., β 115° 20′, space-group $C2/c$, 8 mols. of $C_2N_4H_4$ per unit cell. The positions of atoms have been determined and correspond with a mol. structure consisting of (*A*) and its resonance forms (*B*) and (*C*). Mol. packing is



(*A*.) (*B*.) (*C*.)

dominated by H bonds, one of which is of the rare bifurcated type. The properties of (I) are discussed in relation to the proposed structure. W. R. A.

Electron diffraction investigation of the molecular structure of tellurium tetrachloride. D. P. Stevenson and V. Schomaker (J. Amer. Chem. Soc., 1940, **62**, 1267—1270).—An electron diffraction investigation of gaseous $TeCl_4$ gives Te—Cl = 2·33±0·02 A., Cl—Cl = 5·37±0·06 A., and a bond angle of 93±3°. The mol. has a configuration derived from the trigonal bipyramid, one of the equatorial positions being occupied by the unshared electron pair. This configuration is compatible with the high dipole moment of $TeCl_4$. The "irregular tetrahedral" C_{3v} structure proposed by Kimball (A., 1940, I, 198) is incompatible with these data. W. R. A.

Molecular structure of sulphur dioxide. V. Schomaker and D. P. Stevenson (J. Amer. Chem. Soc., 1940, **62**, 1270—1272).—Redetermination of the electron diffraction of SO_2 (A., 1936, 144) yields S—O = $1·43_3$±0·01 A. and O–S–O angle = 120±5°, in good agreement with 121±5° calc. from bond distance and entropy. W. R. A.

Study of structures of bismuth chloride and bromide molecules in the vapour phase by electron diffraction. H. A. Skinner and L. E. Sutton (Trans. Faraday Soc., 1940, **36**, 681—685).—$BiCl_3$ and $BiBr_3$ have a pyramidal structure, with the following dimensions: Bi—Cl 2·48±0·02, Bi—Br 2·63±0·02 A.; Cl–Bi–Cl 100±6°, Br–Bi–Br 100±4°. F. L. U.

Study of structures of inorganic pentahalide molecules in the vapour phase by electron diffraction. H. A. Skinner and L. E. Sutton (Trans. Faraday Soc., 1940, **36**, 668—680).—The following bond lengths are deduced from the diffraction patterns of $NbCl_5$, $TaCl_5$, $NbBr_5$, and $TaBr_5$: Nb—Cl 2·29±0·03, Nb—Br 2·46±0·03, Ta—Cl 2·30±0·02, Ta—Br 2·45±0·03 A. The contraction of the links in these compounds is of the same order as those observed in $MoCl_5$ and IF_5. The structure is trigonal bipyramidal. F. L. U.

Paramagnetic relaxation times for titanium and chrome alum. J. H. Van Vleck (Physical Rev., 1940, [ii], **57**, 1052; cf. A., 1940, I, 200).—Detailed amendments and corrections. N. M. B.

Method for determining the charging potential of dielectrics and the lower limit of secondary electron emission from a monocrystal of NaCl. I. D. Kirvalidze (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 635—637).—A method for determining the sign of the charge produced by electron bombardment of a crystal, and hence the lower limit of secondary electron emission, is described. For NaCl the limit is ~11 v. F. J. G.

Crystallographic properties of anhydrous and trihydrated sodium carbamates. B. Yoshiki (J. Soc. Chem. Ind. Japan, 1940, **43**, 83 B).—$NH_2·CO_2Na$ forms orthorhombic, acicular or prismatic crystals whilst $NH_2·CO_2Na,3H_2O$ crystals belong to the triclinic system and are granular or short prismatic. Optical consts. have been measured. W. R. A.

Increasing the chemical activity of cadmium iodide by irradiation. J. A. Hedvall, P. Wallgren, and S. Månsson (Trans. Faraday Soc., 1940, **36**, 697—706).—Recent work on the properties of crystals having faulty lattices is reviewed. The possibility of crystals having layer lattices exhibiting different photosensitivity on different surfaces has been examined by irradiating CdI_2 with absorbable λλ on the basal and prism faces. In presence of a little H_2O vapour blackening is produced in the latter but not in the former. Vapours which are more strongly adsorbed than H_2O (C_5H_5N is the most effective) prevent the blackening. Further, the solubility in an EtOH–light petroleum mixture is increased by ~14% by irradiation. F. L. U.

Temperature-dependence of tensile strength of a polystyrene glass. E. Jenckel and P. Lagally

(Z. Elektrochem., 1940, **46**, 186—188).—The tensile strength (*s*) of polystyrene glass fibres (degree of polymerisation 1180, *M* 122,500) has a sharp max. at ~50°, above which *s* falls rapidly. An approx. 2·5-fold fall in *s* occurs with increasing cross-section between 0·015 and 0·077 sq. cm. In contrast with similar glasses of low mol. wt., the max. *s* val. does not correspond with the temp. range of solidification (~85°), or with the " brittle point," which is much lower; it may relate to a second " solidification " region made possible by the multiple modes of linking suggested by Kuhn. A. J. E. W.

Polymorphic forms of organic compounds. J. TIMMERMANS (Bull. Acad. roy. Belg., 1939, [v], **25**, 417—430).—A discussion of a system of classification of the polymorphic forms of groups of org. compounds, with variations of form under various conditions and hypotheses as to origin, based on all available data. N. M. B.

Allotropy in phosphorus and sulphur. K. SCHAUM (Z. Elektrochem., 1940, **46**, 228—231).—A review and discussion from the viewpoint of the general study of allotropy. A. J. E. W.

Galvano- and thermo-magnetic phenomena in iron and nickel. E. H. BUTLER, jun., and E. M. PUGH (Physical Rev., 1940, [ii], **57**, 916—921).—The Hall, Ettingshausen, Nernst, and Righi–Leduc effects, the Thomson coeff., and the thermal and electrical conductivities for bars of Ni and electrolytic Fe were measured. The three independent Sommerfeld–Fermi relations between the effects are verified within a factor of 3. The Fermi statistical conduction theory does not account for the size of an effect unless the average field for the conduction electrons in the Fe is twice, and in Ni ~15 times, the measured val. of the magnetic induction. Explanations are suggested. N. M. B.

Active iron. XIII. [Magnetic] measurements on complex iron cyanides in solution. A. SIMON and H. KNAUER (Z. Elektrochem., 1940, **46**, 13—25; cf. A., 1940, I, 59).—The construction and standardisation (with specially purified H_2O) of an accurate form of Quincke's apparatus for the measurement of χ in solutions are described. Data are recorded for ~0·5M. aq. and dil. $HClO_4$ solutions of $K_3Fe(CN)_6$ and $K_4Fe(CN)_6$, and compared with data for the solutions and solid salts obtained by the Gouy method; χ for aq. $K_4Fe(CN)_6$ falls rapidly on keeping. The effects of dilution and keeping on the χ vals. for aq. $Na_4[Fe(CN)_5AsO_2]$ and $Na_4[Fe(CN)_5NO_2]$, respectively, are also examined. Dissolution reduces χ for paramagnetic salts, whilst diamagnetism is increased. The changes, which are discussed in detail, are attributed to differences in dissociation, hydrolysis, hydration, and polymerisation, the effect of light, and changes in the association of H_2O. Owing to these effects the secondary dissociation of the complexes cannot be studied by χ measurements on their solutions. A. J. E. W.

Magnetic study of polymerisation of styrene. S. S. BHATNAGAR, P. L. KAPUR, and (MISS) G. KAUR (J. Indian Chem. Soc., 1940, **17**, 177—182).—The diamagnetic susceptibility (χ) of styrene increases steadily during polymerisation in vac., whereas in presence of O_2 it first decreases and afterwards rises until the final product has a higher val. of χ than a sample polymerised in vac. The initial low val. is attributed to the formation of peroxides, and the high final val. to the combined effects of anisotropy and the disappearance of double bonds. F. L. U.

Molecular structure of some selenium and tellurium compounds. M. PRASAD and S. S. DHARMATTI (Current Sci., 1940, **9**, 175—176).—The diamagnetic susceptibilities ($-\chi \times 10^6$) of Se_2Br_2, H_2SeO_3, H_2TeO_3, and $TeMe_2I_2$ are 112·6, 45·41, 34·89, and 145·40, respectively, in good agreement with theoretical vals. obtained by the methods of Slater and of Angus. Vals. of χ for the various Se and Te valency states and for S in S_2Cl_2 and SO_2Cl_2 are derived. W. R. A.

Configuration of some cupric, nickelous, and cobaltous complexes by means of magnetic measurements. G. N. TYSON, jun., and S. C. ADAMS (J. Amer. Chem. Soc., 1940, **62**, 1228—1229).—The following *compounds* have been synthesised: salicylaldehyde complexes of Cu^{II} (I), Ni^{II} (II), Co^{II} (III), and salicylaldimine complexes of Cu^{II} (IV) and Ni^{II} (V). From magnetic measurements (II) and (III) are tetrahedral, and (I), (IV), and (V) are planar. (V) is diamagnetic. W. R. A.

Fresnel formulæ applied to the phenomena of non-reflecting films. K. B. BLODGETT (Physical Rev., 1940, [ii], **57**, 921—924).—The amplitudes of rays reflected and transmitted by non-reflecting films of transparent isotropic substances are calc. for (1) a film of refractive index n_1 bounded on both sides by a medium of refractive index n_0, and (2) a film bounded by media of refractive indices n_0 and n_2. For zero reflexion the thickness t of the film must be $n_1t \cos r = (2n+2)\lambda/4$ in (1), and $n_1t \cos r = (2n+1)\lambda/4$ in (2), where r is the angle of refraction of light in the film. N. M. B.

Rotatory dispersion and circular dichroism of *l*-menthyl *d*-β-chloro-β-nitrosobutyrate. S. MITCHELL and G. K. SIMPSON (J.C.S., 1940, 784—787).—The extinction coeff., ε, sp. rotation, [α], and circular dichroism, $\varepsilon_l - \varepsilon_r$, of EtOH solutions of *l*-menthyl *d*-β-chloro-β-nitrosobutyrate have been measured in the region 4800—6800 A., covering the double absorption band due to the NO-group. The curves of ε and $\varepsilon_l - \varepsilon_r$, plotted against λ, are similar in form and each can be represented as the sum of two probability curves. The anisotropy factors $(\varepsilon_l - \varepsilon_r)/\varepsilon$ deduced from the component curves have equal max. By using Lowry and Hudson's equation (A., 1933, 889) the contributions to the [α]–λ curve associated with each of the component circular dichroism curves are evaluated, and by subtracting these from the observed vals. of [α] a curve is obtained which represents the rotatory dispersion after the partial rotation due to the NO-group has been removed. J. W. S.

Thermodynamics of *n*-heptane and ββδ-trimethylpentane, including heat capacities, heats of fusion and vaporisation, and entropies. K. S. PITZER (J. Amer. Chem. Soc., 1940, **62**, 1224—1227).—Molal heat capacities in the solid, liquid, and gaseous

states have been determined for n-C_7H_{16} (I) and $CH_2Pr^{\beta}Bu^{\gamma}$ (II) from 14° to 423° K. The following data are given: heats of fusion and vaporisation, 3355·8±4 and 7660±20 (I), 2201·6±2 and 7410±20 (II) g.-cal. per mol.; $S_{298\cdot1°} = 78\cdot60\pm0\cdot2$ (I) and $78\cdot40\pm0\cdot2$ (II) g.-cal. per degree per mol.; $S_{(gas)371\cdot51°} = 111\cdot77\pm0\cdot3$ (I); $S_{(gas)372\cdot33°} = 112\cdot05\pm0\cdot3$ g.-cal. per degree per mol. W. R. A.

Nucleus formation in molten metals. L. HORN and G. MASING (Z. Elektrochem., 1940, **46**, 109—119).—The formation of solidification nuclei is studied statistically by measuring the degree of supercooling of the melt with different rates of cooling. In the fully automatic apparatus described, which is designed for repeated measurements on the same mass of metal, the specimen is heated to a specified limit above the m.p. and then cooled at a fixed rate; the point of solidification is determined from a photographically-recorded temp.–time curve. Curves are given showing the variation of the no. of nuclei with temp. for Sb and Al. With Sb the supercooling increases rapidly with the temp. of preheating, probably owing to the effect of traces of impurity on nucleus formation, but with Al the effect is smaller. The " radioactive " law of nucleus formation is obeyed by Al, but not by Sb. Photomicrograms illustrating the structure of the solidified reguli are discussed. A. J. E. W.

Rate of evaporation of liquids. W. PRÜGER (Z. Physik, 1940, **115**, 202—244).—The temp. (θ_s) in the surface of a liquid evaporating at normal pressures (p) is slightly > the b.p. (θ_0) determined by the v.p. above the surface; if Δp is the difference of v.p. which corresponds with $\theta_s - \theta_0$, the rate of evaporation is $\mu = K\Delta p$, so long as Δp is small and the rate of supply of heat is not excessive. The evaporation const. K is characteristic of each liquid, and depends on p, θ, and to a marked degree on the condition of the surface. K has approx. the order of magnitude of the evaporation const. in a vac., so that the condensation coeff., f = (mols. condensing)/(mols. striking surface), can be calc. from μ data. $K = 270 \times 10^{-6}$ cm. per sec. per mm. for H_2O at 100°, and $f = 0\cdot02$; with CCl_4 $f = \sim1$, and very few mols. are reflected from the surface. $\theta_s - \theta_0 \approx 0\cdot01°$ in H_2O and $\sim0\cdot001°$ in CCl_4. K for H_2O is much reduced in a glass vessel, owing to the presence of dissolved material in the surface. It is confirmed that there is a linear fall of temp. towards the surface in a surface layer of the liquid a few tenths of a mm. thick; this fall may reach several degrees. The true surface temp. must therefore be obtained by extrapolation, using measurements with very small thermocouples. A. J. E. W.

Variation of physical constants in homologous series. II. Density. V. GÓMEZ ARANDA (Anal. Fis. Quím., 1939, **35**, 45—63).—A reprint of a paper previously abstracted (A., 1938, I, 240). F. R. G.

Sodium chloride at very high pressures. R. B. JACOBS (Physical Rev., 1940, [ii], **57**, 1046; cf. Bridgman, A., 1940, I, 236).—The absence of polymorphic transitions in the range 10^5—2×10^5 atm. is discussed with reference to the free energy–pressure and mol. vol.–pressure curves for body-centred and face-centred NaCl. A theoretical pressure–vol. curve is compared with Bridgman's measurements. N. M. B.

Retrograde condensation. D. L. KATZ and F. KURATA (Ind. Eng. Chem., 1940, **32**, 817—827).—The phase behaviour of simple and complex materials is discussed, with particular reference to a mixture of natural gas and gasoline, for which P–V and P–T relations are illustrated in graphs. Simple rules for nomenclature are recommended and it is suggested that phase behaviour is more accurately described without using the term " retrograde condensation." J. W. S.

Pressure–volume–temperature relations of ethylene in the critical region. I. J. DACEY, R. McINTOSH, and O. MAASS (Canad. J. Res., 1939, **17**, **B**, 206—213).—Regions of const. pressure with changing vol. were observed in isothermals at 8·92°, 9·22°, 9·42°, 9·50°, and 9·60°. The pressure of the heterogeneous system at 9·50° corresponds with that of the flat portion of the homogeneous isothermal at the same temp. and is also identical with that of the system which had been heated at const. vol. to destroy the density difference and then cooled again to 9·50°. A hysteresis which was observed on reversing the direction of measurement of the 9·60° isothermal, *i.e.*, from " vapour " to compressed " liquid," was caused by time lags in passing from the " vapour " region of an isothermal to regions of high density. It is concluded that the gas system, although macroscopically homogeneous at these temp., is still a two-phase system, the effect of the temp. being to disperse, or mix mechanically, the two phases. Mechanical stirring did not influence any of these phenomena. D. F. R.

Pressure–volume–temperature relations for propane. W. W. DESCHNER and G. G. BROWN (Ind. Eng. Chem., 1940, **32**, 836—840).—The P–V–T relations for C_3H_8 have been studied at 100—350° and 1—140 atm. It has $T_{crit.}$ 96·85°, $P_{crit.}$ 42·1 atm., and $d_{crit.}$ 0·224. The saturated-liquid and vapour densities are recorded for 30—96·85°, and the fugacity at various pressures is calc. J. W. S.

Vapour pressure of liquid bismuth between 603° and 638°. A. H. WEBER and S. C. KIRSCH (Physical Rev., 1940, [ii], **57**, 1042—1044; cf. A., 1938, I, 378).—Measurements were made by the method of mol. effusion, the metallic deposits being weighed directly with a micro-balance. The 7 vals. reported are fairly well represented by the empirical equation $\log_{10} p$ (in mm.) $= -52\cdot23(205)/T + 9\cdot03$ in good agreement with that given in the International Critical Tables. N. M. B.

Vapour pressures for six aliphatic nitro-compounds. E. B. HODGE (Ind. Eng. Chem., 1940, **32**, 748).—The v.p. of $MeNO_2$, $EtNO_2$, $Pr^{\alpha}NO_2$, $Pr^{\beta}NO_2$, $CHMeEt\cdot NO_2$, and $BuNO_2$ have been determined and the consts. in the equation $\log P = A/T + B \log T + C$ tabulated. A nomograph is included. D. F. R.

Correlating vapour pressure and latent heat data; a new plot. D. F. OTHMER (Ind. Eng. Chem., 1940, **32**, 841—856).—The v.p. of pure substances and solutions, and the dissociation pressures of salt hydrates and other compounds, yield straight lines when plotted

logarithmically against the v.p. of a reference substance at corresponding temp. This confirms the validity of the relation $\log p = (L/L') \log p' + C$, where p and p' are the v.p. and L and L' are the mol. latent heats, respectively, of the compounds at the same temp., and C is a const. This method of plotting is illustrated for the v.p. of various compounds and solutions in comparison with Cl_2, C_6H_{14}, H_2O, NH_3, or C_6H_6. The method can be used to determine heats of fusion, dissolution, hydration, dilution, or dissociation. The f.p. of salt solutions, enthalpy charts, steam-distillation relations, the composition of vapours from binary solutions, const.-b.p. mixtures, etc. can also be studied by this method. Other equations, useful for similar calculations, are suggested.

J. W. S.

Thermodynamic properties of fluorochloromethanes and -ethanes. A. F. BENNING and R. C. MCHARNESS (Ind. Eng. Chem., 1940, **32**, 698—701; cf. A., 1940, I, 248).—The P–V–T relations of $CHClF_2$, $CHCl_2F$, CCl_3F, and $CCl_2F{\cdot}CClF_2$ have been determined by the measurement of isometrics at 3·5—21 atm. and the results expressed in an equation of state of the Beattie–Bridgeman type (A., 1929, 252). V.d. measurements have also been made at 0·25—2·5 atm. by the Dumas method and above 20 atm. by the dew-point method.

D. F. R.

Thermodynamic properties of fluorochloromethanes and -ethanes. IV. Orthobaric densities and critical constants of three fluorochloromethanes and trifluorotrichloroethane. A. F. BENNING and R. C. MCHARNESS (Ind. Eng. Chem., 1940, **32**, 814—816).—d vals. for $CHClF_2$, $CHCl_2F$, CCl_3F, and $CCl_2F{\cdot}CClF_2$ have been determined between −70° and their crit. temp. (96·0°, 178·5°, 198·0°, and 214·1°, respectively). From these data and the v.p. and v.d. data (cf. A., 1940, I, 248, and preceding abstract) the respective rectilinear diameters are calc.

J. W. S.

Thermodynamic properties of the hexyl alcohols. IV. γ-Methylpentan-α-ol and -δ-ol. F. HOVORKA, H. P. LANKELMA, and I. SCHNEIDER (J. Amer. Chem. Soc., 1940, **62**, 1096—1098).—Vals. of γ, η, ρ, v.p., n, parachor, Eötvös const., degree of association, b.p., heat of vaporisation, and crit. temp. are recorded and discussed.

W. R. A.

Direct comparison on a crystal of calcite of the X-ray and optical interferometer methods of determining linear thermal expansion. Evidence of differences among calcite crystals. J. B. AUSTIN, H. SAÏNI, J. WEIGLE, and R. H. H. PIERCE, jun. (Physical Rev., 1940, [ii], **57**, 931—933).—Measurements by the two methods on the same specimen of calcite gave vals. for the coeff. of linear expansion agreeing within the limit of measurement. Comparison of these results with data for other crystals of calcite shows a significant difference in the expansion of different crystals. The spacing between the (211) planes is also measurably different.

N. M. B.

Viscosity of gases and vapours at high pressures. E. W. COMINGS and R. S. EGLY (Ind. Eng. Chem., 1940, **32**, 714—718).—A graphical method based on the concept of corresponding states is described for predicting the η of pure gases and vapours at high pressures when the η at atm. pressure, and the crit. temp. and pressure, are known. Comparison with published data for seven gases and vapours indicates that above the crit. temp. and pressure the predicted η differs from the experimental val. by <20%. The method may be applied similarly to thermal conductivity and diffusivity of gases.

D. F. R.

Viscosities of linear polyesters. Exact relationship between viscosity and chain length. P. J. FLORY (J. Amer. Chem. Soc., 1940, **62**, 1057—1070).—η for molten linear polyesters (average mol. wt. 200—10,000) is represented satisfactorily by $\log \eta = A + CZ_w^{\frac{1}{2}}$, where Z_w is the wt. average chain length and A and C are consts. The relation also holds for mixtures of two polyesters when one has a low and the other a high average mol. wt. η–T relationships, determined at 80—202°, show that $d \log_e \eta / dT$ is independent of the average mol. wt., indicating that the elementary process causing viscous flow consists of a displacement of a small portion of the entire mol. and is independent of mol. size. ρ and thermal expansion coeffs. of polyesters have been measured from 80° to 167°. The calculation of average mol. wts. from measurements of η is discussed.

W. R. A.

Figures in thin layers of grease and viscous liquids. W. D. KUMLER (J. Physical Chem., 1940, **44**, 612—618).—Figures such as those observed on the rims of vac. desiccators are formed in greases or liquids of suitable η and stickiness when the substance is placed between smooth plates and pressure is applied and subsequently released. The figures consist of holes in the material and their forms vary with η and composition. No relationship exists between tendency to form the figures and polarity or tendency to form liquid crystals.

J. W. S.

Molar zero fluidity volumes of organic compounds. A. S. CHAKRAVARTI (J. Indian Chem. Soc., 1940, **17**, 205—209).—The relationship deduced by Friend (cf. A., 1938, I, 446) between fluidity and sp. vol. has been used to calculate mol. zero fluidity vols. (V_0) for a no. of org. compounds containing N or a halogen. The calc. vals. agree, for the most part closely, with those derived from d and η data, and lead to the following at. vals. of V_0: N 6·0, Cl 18·0, Br 23·0, I 29·0. Some OH-compounds are also considered.

F. L. U.

Generalised thermodynamic potentials for perfect gas mixtures. P. VAN RYSSELBERGHE (Bull. Acad. roy. Belg., 1939, [v], **25**, 314—318).—Mathematical.

N. M. B.

Thermal demixing of gas mixtures. II. Thermodiffusion. N. G. SCHMAHL and J. SCHEWE (Z. Elektrochem., 1940, **46**, 203—212; cf. A., 1936, 1338).—A review of the literature and principles of thermodiffusion is given, and experiments with H_2–HCl, –H_2S, –CH_4, –CO_2, CO–CO_2, and O_2–CO_2 mixtures (generally at pressure p = 300 mm.) are described. The mixtures were allowed to reach equilibrium in two bulbs in direct connexion, one at room temp. (T_1) and the other at 200—1000° (T_2). The dependence of the degree of demixing on the vols. of the bulbs, time,

% composition of the gas mixture, and T_2 is examined. The expression $\Delta\lambda = K_t \log_e T_2/T_1$, in which $\Delta\lambda$ is the change in mol. fraction due to demixing, is verified; K_t, which is const. over the above temp. range, shows an approx. parallelism with the ratio of the mol. wts. of the two gases, but other factors such as the size and "hardness" of the mol. are of greater importance. With H_2–H_2S and –CO_2 $\Delta\lambda$ falls rapidly with increasing p ($\not>$3·5 atm.), although the p coeff. is small at 1 atm.; extrapolation of the curves suggests that no demixing would occur at $\sim$4·3 atm. A. J. E. W.

Variation of the differential diffusion constant of sulphuric acid with temperature. E. A. HOLLINGSHEAD and A. R. GORDON (J. Chem. Physics, 1940, **8**, 423—424).—By a method previously described (A., 1939, I, 192) the diffusion const. of H_2SO_4 has been determined for concns. of 0·025—1·0M. at 10—35°. The variation of the const. with concn. is similar to that at 25°; the mean activation energies of transport for the ranges 10—15°, 15—25°, and 25—35° are 4·9, 4·5, and 3·8 kg.-cal., respectively.
W. R. A.

(A) **Faraday effect and conductivity of electrolytic solutions.** (B) **Faraday effect of strong electrolytes in aqueous solutions. VII. NH_4Cl, $BaCl_2$, $NaNO_3$, KNO_3, Na_2SO_4, $ZnSO_4$, and $NaClO_4$.** A. OKAZAKI (Mem. Ryojun Coll. Eng., 1939, **12**, 33—43, 45—60).—(A) The equiv. % increments of Verdet's const. ω and the rotation const. $D = n\omega\lambda^2/(n^2+2)^2$ of alkali halide solutions are $\propto$ degree of dissociation up to concn. of 6 g.-equiv. per l. The mol. rotations of the salts in dissociated and undissociated states have been calc.

(B) Measurements with D-lines at 25° show that the corr. mol. rotation of the chlorides decreases with increasing concn. and that of $NaClO_4$ increases slightly, while those of the nitrates and sulphates are nearly independent of concn. The val. of e/m for the dispersion electron, its no. per mol., and the λ of the absorption band of these electrolytes (except $NaClO_4$) in dissociated states have been calc. For uni- and bi-valent electrolytes e/m is respectively $<$ and $>$ the accepted val. D. F. R.

Molar volumes of solutes. IV. O. REDLICH (J. Physical Chem., 1940, **44**, 619—629; cf. A., 1931, 905, 1122).—Available data for aq. and non-aq. solutions confirm the relationship between apparent mol. vol. (ϕ) and concn. (c) of electrolytes derived from the Debye–Hückel theory, viz., $\phi = \phi^0 + kw^{1\cdot5}c^{0\cdot5}$. ($w = 0\cdot5\Sigma\nu_i z_i^2$, where ν_i is the no. of ions of species i formed by 1 mol. of electrolyte and z_i is the valency). This equation differs from Masson's empirical rule (A., 1930, 31) in that the factor k should be independent of the electrolyte and should vary only with the solvent and temp., whilst being a limiting law it will apply only at low c. In dil. solutions of non-electrolytes ϕ varies linearly with c. A formula is given for interpolating and extrapolating mol. vols. J. W. S.

Conception of osmotic pressure. A. THIEL (Z. Elektrochem., 1940, **46**, 129—131).—The concept of osmotic pressure (Π) is discussed with reference to diffusion in solutions and phenomena at phase boundaries (solubility of salts and solution tension of metals), in order to reconcile these factors with the modern view that Π is associated with the solution as a whole and is largely a solvent effect, rather than a result of thermal motion of the solute mols. Π must be distinguished from "diffusion pressure," and the idea of a solution pressure acting in opposition to Π must be abandoned in the light of modern theories of electrolytes and ionic activity. A. J. E. W.

Partial pressure of hydrogen chloride from its solutions in *o*-nitrotoluene, *m*-nitrotoluene, and *n*-hexane at 25°. S. J. O'BRIEN and C. L. KENNY (J. Amer. Chem. Soc., 1940, **62**, 1189—1192).—Partial pressures at 25° of HCl from its solutions in *o*- and *m*-$C_6H_4Me{\cdot}NO_2$ and in *n*-C_6H_{14} over the concn. ranges 0·023—0·259, 0·012—0·139, and 0·004—0·02M., respectively, have been measured. The basicities of the solvents are deduced and compared with those deduced from infra-red absorption of HCl in various solvents. In $C_6H_4Me{\cdot}NO_2$, HCl obeys Henry's law and shows negative deviation from Raoult's law, whilst in *n*-C_6H_{14} Henry's law is obeyed and there is positive deviation from Raoult's law. W. R. A.

Apparent and partial molal volumes of sodium chloride and hydrochloric acid in mixed solutions. H. E. WIRTH (J. Amer. Chem. Soc., 1940, **62**, 1128—1134).—The apparent and partial ($\bar{V}$) mol. vols. at 25° of (*a*) aq. NaCl, (*b*) HCl, (*c*) NaCl in HCl solution, (*d*) HCl in NaCl solution have been determined. $\bar{V}$ of NaCl is decreased at const. total vol. ionic strength by adding HCl and the decrease is $\propto$ [HCl], whilst $\bar{V}_{HCl}$ increases at const. total concn. when NaCl is added and the increase is $\propto$ [NaCl]. $\bar{V}_{H_2O}$ for the mixed solutions is greatest in solutions of pure HCl and least in solutions of pure NaCl. These changes are due to changes in the structure of H_2O, caused by ions in solution. W. R. A.

Solubility of nitrogen in liquid iron–chromium and –vanadium alloys. R. M. BRICK and J. A. CREEVY (Amer. Inst. Min. Met. Eng., 1940, Tech. Paper, 1165, 9 pp.; Metals Tech., 7, No. 3).—The alloys were melted in a vac. and, after pretreatment with H_2, were held in contact with N_2 for 2 hr. at 50° above their liquidus temp. With Fe–Cr alloys, the m.p. is lowered by dissolution of N_2. No gas evolution occurred on solidification of alloys with $>$40 at.-% of Cr, and solid ingots of the other alloys were obtained by the use of a H_2O-cooled Cu quenching rod. Determinations of N_2 in the ingots were made by vac. fusion. In agreement with Krivobok (B., 1935, 594) it was found that the solubility of N_2 rises slowly from 0·139 at.-% in Fe to 2·12 at.-% in the alloy with 30 at.-% of Cr, and then more rapidly and linearly to 13·6 at.-% in Cr. The solubility of N_2 in powdered solid Cr at 900° is considerably greater, viz., 37·6 at.-%, and it thus seems probable that in the liquid alloy an unstable nitride phase is formed. Quenched samples of alloys with $>$20 at.-% of Cr and saturated with N_2 show traces of a eutectoid structure, containing about 8 wt.-% of N_2. Preliminary tests indicate that dissolution of N_2 raises the m.p. of Fe–V alloys considerably.
J. C. C.

Solubility of nitrogen in steel.—See B., 1940, 530.

Concentration-dependence of diffusion in solid metals. W. SEITH and J. HERRMANN (Z. Elektrochem., 1940, **46**, 213—218).—Experiments on the diffusion of Mg and Tl in Pb are described; blocks of Pb welded to Pb–Mg or –Tl alloy were heated in a vac. at 220—270° or 260—305°, respectively, and layers of the Pb at known distances from the interface were analysed spectrophotometrically. The diffusion const. of Tl in Pb, which is independent of concn., is given by $D = (9\cdot0 \times 10^4)e^{-24,600/RT}$ (units, cm. and days); as the val. of D is > that for Pb in Pb the heat of relaxation is smaller for Tl. D for Mg in Pb depends on concn., and when extrapolated to zero concn. is still ≫ the self-diffusion const. of Pb. A. J. E. W.

(A) **Calculation of the diffusion coefficient of mixtures of powdered metals.** S. D. HERTZRIKEN and M. A. FAINGOLD. (B) **Diffusion of zinc into α-brass.** S. D. HERTZRIKEN, I. SACHAROV, and L. STOLPER (Mém. Physique, Kiev, 1940, **8**, 127—134, 135—142).—(A) Mathematical. The coeff. of diffusion of Ni into Cu is $D = 3 \times 10^{-5}$ sq. cm. per 24 hr. at 850°.

(B) D, determined by the method of vac. evaporation, rises from 0·18 to $2\cdot0 \times 10^{-3}$ sq. cm. per 24 hr. from 600° to 750°. R. T.

Solid solubility of chromium in aluminium containing up to 2% of magnesium. W. HOFMANN and R. W. HERZER (Metallwirts., 1940, **19**, 141—143).—From resistance measurements and microscopical examination it has been shown that the solubility of Cr in very pure Al is 0·56% and 0·3% at 600° and 500°, respectively, but that it is reduced by addition of Mg until with 2% of Mg present the solubilities of Cr are 0·38% and 0·2% at these temp., respectively. J. W. S.

Nature of certain intermetallic lattices. A. L. NORBURY (J. Inst. Metals, 1939, **65**, Advance copy, 611—634).—The structure of complex lattices based on the "basic" body-centred cubic, close-packed hexagonal, and NiAs lattices are shown to be capable of derivation from the basic lattice by the replacement of atoms by electrons, or vice versa; *e.g.*, γ-brass is formed from 27 body-centred cube-units by 2 electrons replacing 2 atoms, thus $27(3e : 2a) + 2e - 2a = 83 : 52$ for the electron (e) : atom (a) ratio, instead of 21 : 13, and $Cu_{21}^{\cdot}Zn_{31}^{\cdot\cdot}$ instead of $Cu_5^{\cdot}Zn_8^{\cdot\cdot}$ for the formula. Other $e : a$ ratios are $84e : 51a$ for γ-brass, $85e : 50a$ for γ_2-brass, $39e : 21a$ for ζ_2-Cu–Al, $40e : 20a$ for η_2-Cu–Al, and $28e : 12a$ for $CuAl_2$. Similarly the basic $7e : 4a$ hexagonal lattice forms subsidiary lattices at $14e : 9a$ (ζ-Ag–Zn) and $15e : 7a$ (Co_2Al_5), and the basic $10e : 4a$ NiAs lattice forms subsidiary lattices at $35e : 21a$ (γ′-CoSn), $37e : 19a$ (PtPb), $39e : 17a$ (η-Cu–Sn), and $42e : 14a$ (FeS). The ordered electron–atom replacement which occurs in the formation of the above types of subsidiary lattices is ascribed to energy exchange between the at. electron shells and the free electrons. A disordered replacement may also occur with the formation of a solid solution having the same lattice; this is ascribed to energy exchange between the electron shells of solvent and solute atoms. A. R. P.

Thermodynamic analysis of liquidus curves of intermetallic compounds. K. HAUFFE and C. WAGNER (Z. Elektrochem., 1940, **46**, 160—170).—Formulæ are derived by which the concn.-dependence of the chemical potential (μ) of the components of alloy phases in binary systems can be deduced from measurements on the liquidus curves. μ–mol. fraction curves are obtained from the liquidus curves for Bi_2Mg_3, $AuIn_2$, Bi_2Ca_3, $SnMg_2$, $LaAl_2$, $PrAl_2$, and $SnLa_2$, which include cases in which the liquidus is approx. parabolic, and in which it is composed of approx. linear segments. The μ curve for each component generally has a flattened S-shape, a rapid increase of μ occurring in the neighbourhood of the m.p. max.; with Bi_2Mg_3, Bi_2Ca_3, and $SnMg_2$ this can be explained if a salt-like structure (*e.g.*, $Mg_3^{2+}Bi_2^{3-}$) is assumed for the cryst. and liquid phases, but in the other cases cited such a structure is not possible. A. J. E. W.

***X*-Ray study of alloys of silver with lead, bismuth, and thallium.** H. H. CHISWIK and R. HULTGREN (Amer. Inst. Min. Met. Eng., Tech. Paper 1169, 1940, 5 pp.; Metals Tech., 1940, **7**, No. 3).—*X*-Ray diffraction measurements confirm that the Ag–Pb and Ag–Bi systems are of the simple eutectic type. The solubility of Pb in Ag varies from 1·3% at 300° to 0·6% at 250°, and of Bi from 1·5% at 260° to 0·6% at 200°. Preliminary measurements suggest that the solubility of Tl in Ag is ~9% at 287°. J. C. C.

Structure of alloys in the system silver–antimony. F. WEIBKE and I. EFINGER (Z. Elektrochem., 1940, **46**, 53—60).—Detailed thermal, micrographic, and *X*-ray data for the concn. range 17—31 wt.-% of Sb are used to construct the phase diagram for the system. Two intermediate phases, ε and ε′, occur at room temp.; the boundary on the Sb side for ε mixed crystals is at Sb 16·7—17·0% at 400—500°, and their structure is hexagonal close-packed with a 2·956—2·961, c 4·787—4·789 A., c/a 1·620—1·618 at this boundary. The ε′ phase (Ag_3Sb mixed crystals) has a high-temp. modification, ε″, which gives an almost identical *X*-ray diagram, showing that the two forms differ only in their state of order; the ε′ and ε″ field extends from Sb 23·5—22·6—20·0% at 400—500—562° to Sb 28·6%, and the transition points are 440° and 449°, respectively, at these limits. Above 28·6% the ε′ and ε″ phases occur in equilibrium with Sb, and ε″ gives a eutectic melting at 484°. The ε″ phase is formed peritectically from ε and the melt at 562°. The ε′ and ε″ phases are rhombic, with a 2·980, b 5·171—5·164, c 4·736—4·725 A. (400—500°) on the Ag side, and a 2·988, b 5·235, c 4·846 A. (400°) on the Sb side. The variation of the lattice consts. with concn. is not linear. A. J. E. W.

Electrochemical studies on the system silver–antimony. F. WEIBKE and I. EFINGER (Z. Elektrochem., 1940, **46**, 61—69).—Accurate e.m.f. (E) measurements on the cell Sb–Ag|LiCl–KCl eutectic, $SbCl_3$|Sb have been made at 430° and 470°, using Sb–Ag alloys containing 2—31·6 at.-% of Sb. The vals. of E and dE/dT are discussed with reference to the phase diagram (cf. preceding abstract). With Sb >26·1 at.-% E = 40—50 mv., although this alloy contains eutectically-deposited Sb, and the vals. of dE/dT are unusually high, suggesting that the

measured E vals. do not relate only to the process of alloy formation. dE/dT varies steadily with [Sb] in the α, ε, and ε' phase regions, indicating a statistical distribution of atoms in the lattices; an abrupt change occurs at the ε'–ε'' transition point, probably owing to an order–disorder effect. The results are used to calculate vals. of the apparent change of partial mol. free energy (ΔF) and entropy, and of the heat of formation, which is negative and relatively high. ΔF has a max. val. of $\sim$1 kg.-cal. per g.-atom with 26·1 at.-% of Sb. The heat of transformation of ε'' into ε' is $-1·26$ kg.-cal. per g.-atom, and this transition is an example of a change which is endothermic on cooling. A. J. E. W.

Process of precipitation from solid solution. I. Crystallographic mechanism for the Al–Cu alloys. C. H. Samans (Amer. Inst. Min. Met. Eng., 1940, Tech. Paper 1186, 10 pp.; Metals Tech., 7, No. 3).—It is suggested that pptn. of θ-$CuAl_2$ from the supersaturated solid solution takes place in 7 stages. Groups containing the required no. of Cu atoms first segregate by chance, and these re-align themselves into an ordered arrangement to form nuclei of θ'-$CuAl_2$ which then grow and are pptd. as particles by formation of interfaces. The Cu atoms then re-align themselves more symmetrically, after which the Al atoms on the (011) planes " buckle " or shear on alternate planes by 0·544 A. in the [100] direction, and finally the Al atoms on the (101) planes " buckle " by the same amount in what was originally the [010] direction. J. C. C.

Aluminium-silicon alloys.—See B., 1940, 535.

***X*-Ray study of the constitution of aluminium–zinc alloys of high purity above 275°: new high-temperature *X*-ray camera.** E. C. Ellwood (J. Inst. Metals, 1940, **66**, 87—96).—The camera is described in detail and figured; it permits the direct X-ray examination of alloys sealed, in the form of fine powder, into a thin (0·5-mm.) glass tube, and heated at temp. up to 450°. No evidence was found of a peritectic reaction at $\sim$380° in Al–Zn alloys with 40—55 at.-% Zn; the diagram of Gayler and Sutherland (A., 1938, I, 69) is, therefore, confirmed. A. R. P.

Solubility of lead in tin. A. Stockburn (J. Inst. Metals, 1940, **66**, 33—38).—Micrographic examination and resistivity measurements indicate that Sn dissolves 2·0—2·1% of Pb at the eutectic temp. (183°); the solidus at the Sn end is almost a straight line joining the m.p. of Sn and the eutectic horizontal at $\sim$2% Pb. A. R. P.

***X*-Ray investigation of aluminium-rich iron–nickel–aluminium alloys after slow cooling.** A. S. Bradley and A. Taylor (J. Inst. Metals, 1940, **66**, 53—65).—The following phases have been identified by X-ray powder photographs of slowly cooled alloys: α-face-centred and β-body-centred cubic phases of the Ni–Fe system; α_1 (Ni_3Al or Ni_3Fe), β_1 (Fe_3Al) and β_2 (NiAl or FeAl) corresponding with the α and β phases, respectively, but with superlattices; trigonal δ (Ni_2Al_3), orthorhombic ε ($NiAl_3$), face-centred cubic κ (Al), λ_1 (Fe_2Al_7), monoclinic μ (Fe_2Al_5), rhombohedral ν ($FeAl_2$), hexagonal π (Fe_3NiAl_{10}), and monoclinic (?) ρ ($FeNiAl_9$ or possibly $FeNi_2Al_{13}$). Ternary δ contains a max. of 1—2% of Fe, but the Al may vary within 6%; ε dissolves up to 4% of Fe by replacement of Ni, whereas κ is almost pure Al and may be in equilibrium with λ_1, ε, or ρ, according to the composition. The narrow limits of the λ_1 phase field of the Fe–Al system are considerably widened by addition of Ni, which produces wide variations in the axial ratios and hence marked changes in the high-order reflexions; this gives rise to several super-structure phases of the λ type corresponding with those found in the Fe–Cu–Al system. The π phase dissolves appreciable amounts of Ni and Al without losing its homogeneity, but the ρ phase has only a narrow range of composition. Analogies are pointed out between the Co–Al and the Fe–Ni–Al systems, from which it is inferred that Co is intermediate in metallic properties between Fe and Ni. A. R. P.

Nickel–beryllium constitutional diagram. S. Okamoto (Japan Nickel Rev., 1940, **8**, 125—131).—The diagram has been redetermined by means of thermal analysis, microscopical examination, magnetic and X-ray analysis, and hardness measurements. The results are in general agreement with those of Masing and Dahl (B., 1929, 724). The compound Ni_5Be_2 was not found within any temp. range. The solid solubility of Be in Ni (the α solution) is $<$1% at room temp., 2% at 900°, 2·6% at 1000°, and 2·8% at 1100°. The eutectic composition and temp. are Be 5·7% and 1153°. Within the range Be 1—13% there are two phases, α and β (solution of NiBe in Ni). The Curie point for annealed saturated α is 255°, and for the quenched supersaturated solution may be as low as 90°. S. J. K.

Niobium–nickel alloys.—See B., 1940, 533.

Anomaly in nickel-rich solid solution of nickel–chromium binary system. Z. Yano (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 110—117).—Electrical and dilatometric measurements and X-ray analysis show that the anomaly in the Ni-rich Ni–Cr solid solution resembles that in the Ni–Cu–Zn system, indicating an order–disorder transformation. L. J. J.

Magnetic study of the two-phase iron–nickel alloys. A. T. Pickles and W. Sucksmith (Proc. Roy. Soc., 1940, **A**, **175**, 331—344).—Measurement of magnetic saturation intensity of annealed Fe–Ni alloys shows that there is a two-phase field in the Fe-rich part of the system. Phase boundaries were determined above 450° and the relation of the equilibrium diagram to the thermal hysteresis observed with normal rates of cooling is studied. G. D. P.

Replaceability of mercury by gallium in dental stoppings. F. Weibke and E. Hesse (Z. Elektrochem., 1940, **46**, 219—222).—A ternary diagram for the system Ag–Ga–Sn (excluding the extreme Ag corner) is discussed with reference to the suitability of the alloys for dental stoppings. Alloys prepared by rubbing Ag–Sn into liquid Ga are unsuitable, as they are too soft in the available concn. range (15—40% Ga); the m.p. of harder alloys with $<$15% Ga are too high. A. J. E. W.

Solubility of methane in benzene. E. P. Schoch, A. E. Hoffmann, A. S. Kasperik, J. H. Lightfoot, and F. D. Mayfield (Ind. Eng. Chem., 1940, **32**, 788—791).—An apparatus for measuring the *P–V–T* relations of mixtures of hydrocarbons at pressures $\not>$400 atm. is described. Sp. vol. and bubble point pressure data for 11 mixtures of CH_4 and C_6H_6 (19—76 mol.-% CH_4) at 100·27° F. are recorded. J. W. S.

Solubility of cadmium and zinc oxalates in salt solutions. W. C. Vosburgh and J. F. Beckman (J. Amer. Chem. Soc., 1940, **62**, 1028—1031).—Vals. are given for the solubilities of CdC_2O_4 in $KClO_4$, $Cd(ClO_4)_2$, and K_2SO_4 solutions. The solubility increases with the concn. of K_2SO_4, $CdSO_4$, and $Cd(ClO_4)_2$ but is independent of the concn. of $KClO_4$ solutions, indicating the presence of $CdC_2O_4,Cd^{\cdot\cdot}$ and CdC_2O_4,SO_4'', in which $CdSO_4$ is regarded as incompletely dissociated. The presence of $ZnC_2O_4,Zn^{\cdot\cdot}$ explains the solubility of ZnC_2O_4 in $ZnSO_4$. Recalc. vals. of the instability consts. of the ions $Cd(C_2O_4)_2''$ and $Zn(C_2O_4)_2''$ are given. W. R. A.

Influence of electrolytes on solubility of organic substances in water. A. J. A. van der Wyk (Arch. Sci. phys. nat., 1940, [v], **22**, Suppl., 23—26).—Theoretical. The difference between the heats of dissolution of a sparingly sol. org. substance in H_2O and in an aq. salt solution is compounded of three terms referring to the effect of the salt on the H_2O, and to complex formation with the anion and the cation. Consideration of the dependence of these on concn. leads to the equation
$-(RT/x)\log_e(l_x/l_0) = C_0 + C_1/(K_1 + x) + C_2/(K_2 - x)$
where l_0 and l_x are the solubilities of the org. substance in H_2O and in salt solution of concn. x, and C_0, C_1, C_2, K_1, and K_2 are consts. The form of this equation provides for the great complexity of observed relationships. F. J. G.

Sorption of chlorine by active charcoal. III. Sorption isotherms at low pressure. K. Arii (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 148—159; cf. A., 1939, I, 21).—Sorption isotherms for Cl_2 on sugar C activated by heating at 900°, determined at 20—40° and 0·05—50 mm. Hg, give for the amount sorbed (a) in mg. per g. the general equation $a = 165{\cdot}58p^{0{\cdot}0578} - (2{\cdot}0968 - 0{\cdot}742 \log p)\theta$. L. J. J.

Adsorption of electrolytes by active carbon. (Application of polarographic method.) Y. Terui (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 160—166).—The wts. adsorbed at 25° by 1 g. of active C from Tl_2SO_4 and $CdCl_2$ solutions at initial concns. 0·004—0·0001 and 0·005—0·0005 g.-ion per l. are $0{\cdot}000733C^{0{\cdot}519}$ and $0{\cdot}000239C^{0{\cdot}240}$, respectively, in g.-ion $\times 10^{-6}$ per l., where C is the equilibrium concn. of the ion in g.-ion per l. L. J. J.

Polarisation and colour changes due to adsorption on surface-active substances. III. E. Weitz, F. Schmidt, and J. Singer (Z. Elektrochem., 1940, **46**, 222—227; cf. A., 1940, I, 109, 158).—Further cases are cited in which colourless or weakly coloured org. compounds give strongly coloured adsorbates on Al_2O_3, SiO_2 gel, and other surface-active substances, owing to formation of heteropolar structures on adsorption. The compounds studied include derivatives of $CPh_3{\cdot}OH$, fuchsin, and diphenylphthalide, unsaturated ketones, 1 : 8-diphenyloctatetraene, and $CHPh{:}CH{\cdot}NO_2$. Tetramethyldiaminodiphenylphthalide ("malachite-green lactone") gives greenish-blue adsorbates on numerous compounds, even when rubbed with the dry adsorbent; the adsorbates probably contain the heteropolar betaine form. The closely related rhodamine-*B* base behaves in a similar way. In general the compounds are adsorbed from C_6H_6 solution, and the adsorbates are readily eluted with EtOH or $COMe_2$. A. J. E. W.

Specific action of ultra-short waves. M. Thiis (Strahlenther., 1939, **66**, 494—514).—No changes in surface tension were observed when a no. of org. and inorg. compounds in aq. or colloidal solution or in suspension and a no. of foams were subjected to a high-frequency field. E. M. J.

Surface covering and energy of adhesion of organic compounds. P. A. Thiessen and E. Schoon (Z. Elektrochem., 1940, **46**, 170—180).—An expression is derived by which the energy of adhesion (W_A) of a liquid drop on an insol. solid surface can be calc. from the contact angle (θ). A photographic method for the determination of θ from drop profiles, and its application in typical cases, are described. Data are given for H_2O on $C_{30}H_{62}$, $C_{31}H_{64}$, cetyl palmitate, stearic acid, and $(CH_2)_n(CO_2H)_2$ ($n = 14$, 16). θ vals. on dry and wet surfaces may differ by 30—35° if polar groups lie in the surface. W_A is a measure of the polarity of the surface, and therefore of the exposed groups; this is confirmed qualitatively by adsorption of radioactive material. At surfaces composed of Me and CO_2H groups, $W_A = \sim 52$ and 123 ergs per sq. cm., respectively. The approx. surface energies are deduced to be 3·7 and 39·25 in air, and 24·5 and —10·95 ergs per sq. cm. at interfaces with H_2O. A. J. E. W.

Oxidation of drying oils in unimolecular layers.—See B., 1940, 544.

Cybotaxis at interfaces. T. H. Hazlehurst and H. A. Neville (J. Physical Chem., 1940, **44**, 592—600).—The existence of primary rolling drops is attributed to cybotaxis, a relative measure of which can be obtained from the "crit. heights" of different liquids (cf. A., 1938, I, 135). The stability of a gas bubble at a liquid–liquid interface depends on cybotaxis in the lower liquid, so that at H_2O–oil interfaces a bubble will break through from the H_2O to the oil, but not in the reverse direction, whilst oil drops will break through from the H_2O side, but H_2O drops cannot break through from the oil side. If other factors are absent, a H_2O-in-oil emulsion is more stable than an oil-in-H_2O emulsion. In accord with the theory, an emulsifying agent stabilises systems in which it is preferentially in the external phase. In thixotropic systems cybotactic groups are supposed to extend as spines from active spots on the particles and form bridges which offer resistance to shear. If equilibrium conditions of interfacial energies are satisfied, drops of an immiscible liquid

or solid particles, but not gas bubbles, can rest in a liquid–liquid interface in contact with both phases. J. W. S.

Agaric acid and the Donnan theory of membrane equilibrium. R. J. HARTMAN, E. W. KANNING, and J. E. WEBER (J. Amer. Chem. Soc., 1940, **62**, 1302—1303).—The membrane (*a*) and H electrode (*b*) potentials for the system agaric acid (I)–HCl have been measured using a cell consisting of two saturated calomel electrodes and a " parlodion " membrane with dil. HCl outside and (I) (1·25%) in $Ca(OH)_2$ or HCl inside the membrane. After $\sim$ 24 hr. equilibrium was established and (*a*) and (*b*) were approx. equal. The membrane potential arises from the unequal distribution of H˙ and Cl′ ions since no agarate or Ca ions could be detected in the HCl (outside) solution. When (*b*) is plotted against final p_H of the inside solution two max. at p_H 3·0 and 1·0 are revealed. The latter is attributed to the hydrolytic decomp. of (I) into simpler units. W. R. A.

Measurement of thermal motion in aërosols and its use in the determination of particle size. A. WINKEL and H. WITZMANN (Z. Elektrochem., 1940, **46**, 181—185).—A method of following the motion of individual aërosol particles (radius r <500 mμ.) in a closed cell is described. The particles are photographed at short intervals (0·05 sec.) on a regularly displaced film, and their thermal motion and rate of sedimentation are determined from measurements on the negative; r may be calc. from either of these determinations, but the second often gives high results owing to convection effects. The method is rapid and particularly suitable for determination of the r distribution in fine aërosols. Photophoresis effects can be measured. r data are given for tobacco smoke and paraffin and Sudan-red 3 aërosols. A. J. E. W.

Composition of mixed vapours in the cloud chamber. T. N. GAUTIER and A. E. RUARK (Physical Rev., 1940, [ii], **57**, 1040—1041).—The difference in composition of alcohol–H_2O vapours in cloud chambers from the liquid mixtures producing them must be considered when ranges or cross-sections are calc. Curves are given for EtOH and H_2O, showing, for various temp., the v.p. of each constituent as a function of vol.-% of EtOH in the liquid. N. M. B.

Diffusion, Brownian movement, Loschmidt–Avogadro number, and light. F. EHRENHAFT (Physical Rev., 1940, [ii], **57**, 1050; cf. A., 1940, I, 277).—The importance of the influence of magnetophotophoresis in the geomagnetic field on observations and theory of Brownian movement is emphasised. N. M. B.

Molecular interactions at oil–water interfaces. I. Molecular complex formation and stability of oil-in-water emulsions. II. Phase inversion and stability of water-in-oil-emulsions. J. H. SCHULMAN and E. G. COCKBAIN (Trans. Faraday Soc., 1940, **36**, 651—661, 661—668).—I. Optimum stability of Nujol-in-H_2O emulsions is secured by the presence of an interfacial film which is electrically charged and in a condensed state. Such films are afforded by pairs of substances, one H_2O-sol., the other oil-sol., that are shown by experiments with an air–H_2O interface to form complexes; stability of the latter is increased by an excess of the H_2O-sol. component, whilst only a monolayer of the oil-sol. component is necessary. The stability of the films, and consequently of the emulsions also, depends mainly on the extent of interaction between the non-polar parts of the two mols., and this in turn is affected by their configuration; thus Na cetyl sulphate gives good emulsions with elaidyl alcohol but poor ones with oleyl alcohol.

II. Stability of H_2O-in-Nujol emulsions requires an interfacial film which is rigid or very viscous and electrically uncharged. Phase inversion occurs when a stable Nujol-in-H_2O emulsion is treated with multivalent ions so as to neutralise the existing charge on the film and interlink adjacent mols., or when a substance forming a non-ionised or isoelectric complex with the film is added (*e.g.*, tannic acid at a suitable p_H to an emulsion stabilised with $C_{17}H_{35}{\cdot}NH_2,HCl$). A H_2O-in-Nujol emulsion can be prepared directly by using a suitable pair of neutral substances, *e.g.*, cholesterol and digitonin. A mechanism of phase inversion is given. The H_2O droplets in emulsions of the inverted type are contained in more or less rigid sacks and are usually not spherical. F. L. U.

Determination of emulsifying efficiencies. L. H. COHAN and N. HACKERMAN (Ind. Eng. Chem. [Anal.], 1940, **12**, 210—213).—Apparatus and procedure for measuring the turbidity of a standard emulsion after different times of treatment are described. The method is compared with microscopical examination and with measurement of the time of creaming of the emulsions. Examination of the effect of temp. during emulsification on the turbidity of the resultant emulsion shows that temp. should be kept at 35°±3° for making accurate comparisons of emulsifying efficiency. L. S. T.

Particle size determination of colloidal systems by the supercentrifuge. E. A. HAUSER and H. K. SCHACHMAN (J. Physical Chem., 1940, **44**, 584—591).—A method is derived for determining the particle size distribution in colloidal systems from the distribution of the material deposited on passage through a Sharples ultracentrifuge. J. W. S.

Coefficient of thixotropy of suspensions of carbon black in mineral oil. J. E. ARNOLD and C. F. GOODEVE (J. Physical Chem., 1940, **44**, 652—670).—Details are given for the calibration and method of operation of an instrument similar to that previously described (A., 1939, I, 160) for measuring anomalous viscosity. Suspensions of C black in liquid paraffin can be milled to give const. and reproducible thixotropy. For the concn. range 4—7%, the coeff. of thixotropy (θ) of these suspensions $\propto$ (concn.)^2. Temp. has little effect on θ, but has the normal large effect on the residual viscosity. The results are interpreted in terms of the impulse theory of thixotropy. J. W. S.

Determination of the lifetime of active polymeric molecules. T. T. JONES and H. W. MELVILLE (Proc. Roy. Soc., 1940, **A, 175**, 392—409).—A method of determining the distance of diffusion of a

polymerisation reaction is described and applied to the photo-polymerisation of $CH_2:CH\cdot CO_2Me$. G. D. P.

Reaction of pectins with acids. T. K. Gaponenkov (J. Appl. Chem. Russ., 1940, **13**, 281—284).—Sugar-beet Ca Mg pectate acts as a buffer substance; it gives up $H^\cdot$ to alkaline, and takes up $H^\cdot$ from acid, solutions. R. T.

Viscosity of stannic phosphate gels during setting. M. Prasad and K. V. Modak (Proc. Indian Acad. Sci., 1940, **11**, **A**, 282—287).—The η of gel-forming mixtures of various amounts of $SnCl_4$ and H_3PO_4 have been measured during gelation at const. temp. η increases with time, but, for a const. amount of $SnCl_4$, increasing amounts of H_3PO_4 increase the rate of change of η, whilst addition of increasing amounts of $SnCl_4$ to a fixed amount of H_3PO_4 decreases the rate of change of η. Tentative explanations are given. Increased temp. causes a small decrease in η in the early stages of gelation, but, beyond a certain stage, the rate of change of η is increased. On the other hand, addition of EtOH diminishes the rate of change of η. W. R. A.

Kinetics of sol-gel transformation. III. Influence of temperature on the setting of some inorganic jellies. H. L. Dube and S. Prakash. **IV. Influence of purity of the sol on the setting of ferric arsenate and ferric phosphate jellies.** H. L. Dube (Proc. Indian Acad. Sci., 1940, **11**, **A**, 318—330, 331—346).—III. The expression $\log S = \log R + p \log C$ (A., 1934, 606) has been tested for $FePO_4$ (I), $FeAsO_4$ (II), $Al(OH)_3$ (III), and $Zr(OH)_4$ (IV) sols of various concns., and found to be universally applicable. For (I), (II), and (IV), $\log R$ increases and p decreases slightly with temp., and for (III), $\log R$ increases and p remains const.

IV. With increasing purity of sol, vals. of p and $\log R$ increase when setting is carried out in the presence of KCl, but decrease with K_2SO_4. It is suggested that jellies from the same sol set with different electrolytes are characteristically different in texture. W. R. A.

Elasticity of rubber.—See B., 1940, 552.

Solubility of cellulose derivatives.—See B., 1940, 519.

Morphological character of gelatinisation of nitrated cellulose membranes. G. Mangenot and (Mlle.) M. Raison (Compt. rend., 1940, **210**, 674—676).—In general, di- and tri-nitrated cotton and ramie fibres immersed in glyceryl trinitrate, $MeNO_3$, diethylene glycol nitrate (I), and *cyclo*-pentanone (II) swell to a gel and then dissolve. Di- or tri-nitrated cotton is attacked by (II) diluted with C_6H_{14} without appreciable swelling; if a dye which colours the gelatinised fibre (*e.g.*, Sudan-red) is added, microscopical examination shows a pattern of rings and spirals on the fibre surface. The action of (I) is similar, but swelling is more pronounced. Dinitrated ramie in (I) splits off acicular fragments parallel to the axis of the fibre, and no patterns are observed. Cotton and ramie fibres thus appear to possess different structures, which are probably related to the "ring" and "fibre" structures of Frey-Wyssling (cf. A., 1937, III, 157). A. J. E. W.

Imbibition of methæmoglobin solutions by cellulose.—See A., 1940, III, 607.

Hydrogenation-dehydrogenation equilibria in gases. H. Zeise (Z. Elektrochem., 1940, **46**, 293—296).—Equilibrium consts. and degrees of dissociation for various reactions paraffin $\rightleftharpoons$ olefine + H_2 between 300° and 1500° K. have been deduced from vals. of $\Delta G/T$ (G = free enthalpy) calc. according to Pitzer's theory (cf. A., 1937, I, 398, 557). C. R. H.

Equilibrium constants for the systems alkyl formates and alkyl acetates with stearic acid. C. Barkenbus, C. A. Roswell, and A. E. Mitts (J. Amer. Chem. Soc., 1940, **62**, 1251—1253).—Ester interchange with acids (acidolysis) has been studied by determining the equilibrium const. K for the reaction of Me, Et, Pr^α, Pr^β, Bu^α, Bu^β, and n-C_5H_{11} formates and Me, Et, Pr^α, Bu^α, and n-C_5H_{11} acetates with stearic acid. K decreases as the length of the alkyl group of the ester increases; higher vals. are obtained when the ester has 5 C. Lower K vals. are given by branched-chain alkyl esters than by n-alkyl esters. Activity is much less influenced by the acid than by the alkyl chain. Formates are more active than acetates and, except for $Pr^\alpha CO_2Me$, K vals. then decrease slightly with increasing length of the acid chain. W. R. A.

Equilibrium in an esterification reaction with perchloric acid as catalyst. H. M. Trimble and E. L. Richardson (J. Amer. Chem. Soc., 1940, **62**, 1018—1019).—The reaction AcOH + EtOH $\rightleftharpoons$ EtOAc + H_2O in the presence of $HClO_4$ has been studied, using up to 25·79 mol.-% of catalyst. The apparent equilibrium const. K and the mol.-% m of $HClO_4$ are related by $K = 3{\cdot}45 + 0{\cdot}68m$ up to m = 11. This equation cannot be explained as due to a combination of H_2O with $HClO_4$ to form a definite hydrate as proposed by Jones and Lapworth (J.C.S., 1911, **99**, 1427). W. R. A.

Ionisation of calcium phytate.—See A., 1940, III, 618.

Dissociation constants of arsenious acid and hydroxylamine. F. Ishikawa and I. Aoki (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 136—141).—Glass electrode measurements of p_H at 25° in $HAsO_2$–$NaAsO_2$ and $NH_3(OH)\cdot Cl$ solutions give vals. $8{\cdot}4 \times 10^{-10}$ and 4×10^{-8} for the dissociation consts. of $HAsO_2$ and NH_2OH, respectively. L. J. J.

Strength of carbonic acid. Rate of reaction of carbon dioxide with water and hydroxyl ion. A. R. Olson and P. V. Youle (J. Amer. Chem. Soc., 1940, **62**, 1027—1028).—The catalytic efficiency of HCO_3' indicates that the first ionisation const. of H_2CO_3 is $\sim 2 \times 10^{-4}$. The heats of activation of (i) $CO_2 + H_2O = H_2CO_3$ and (ii) $CO_2 + OH' = HCO_3'$ are 19 and 10—13 kg.-cal. per mol., respectively. W. R. A.

Phase segregation and its relation to the properties of the system palladium-hydrogen. D. P. Smith (Trans. Electrochem. Soc., 1940, **78**, Preprint 5, 53—66).—Theoretical. A survey of literature on the system Pd–H suggests that the α and β phases do not form an aggregate but are wholly segregated. Segregation offers an explanation of

anomalies, hitherto unexplained, observed in the electrical conductivity and dissociation tension of the system. C. R. H.

F.p. and solubility data for the system chlorine monoxide–water. C. H. SECOY and G. H. CADY (J. Amer. Chem. Soc., 1940, **62**, 1036—1038).—The f.p.–composition curve of the system Cl_2O–H_2O has been investigated over the range 0—100%. H_2O and Cl_2O are partly miscible and the point represented by Cl_2O 20·7 mol.-%, 236·8° K., is invariant. Solid HOCl is not obtained, but $HOCl,2H_2O$ separates from solutions of concn. >11·7 mol.-% of Cl_2O. The f.p. of Cl_2O is −120·6°. The solubilities at various temp. of Cl_2O in H_2O and H_2O in Cl_2O are given. W. R. A.

Phase equilibria in hydrocarbon systems. B. H. SAGE, H. M. LAVENDER, and W. N. LACEY (Ind. Eng. Chem., 1940, **32**, 743—747; cf. A., 1940, I, 65).—The sp. vols. of six CH_4–$C_{10}H_{22}$ mixtures have been determined at 70—250° F. and at pressures ≯4500 lb. per sq. in. The partial sp. vols. in the liquid phase are given in tabular and graphical form. D. F. R.

Liquid–vapour equilibrium of the system aniline–water. J. GRISWOLD, D. ANDRES, E. F. ARNETT, and F. M. GARLAND (Ind. Eng. Chem., 1940, **32**, 878—880).—The compositions of the liquid and vapour phases of the system NH_2Ph–H_2O have been studied at 745 mm. over the complete composition range. The variation of the composition of the NH_2Ph and vapour phases with change of pressure at 100° is also recorded. J. W. S.

***X*-Ray investigation of the system Cr_2O_3–NiO.** L. THOMASSEN (J. Amer. Chem. Soc., 1940, **62**, 1134—1136).—Equilibrium diagrams indicate the spinel NiO,Cr_2O_3 as the only compound present. The solubility of Cr_2O_3 and of NiO in the spinel is small. Lattice consts. for NiO and various mixtures are given. NiO does not dissolve Cr_2O_3. W. R. A.

Dehydration of zinc sulphate heptahydrate by the aqueous method. Solubility curve of different hydrates. R. ROHMER (Compt. rend., 1940, **210**, 669—671; cf. A., 1939, I, 523).—$ZnSO_4,7H_2O$ is slowly dehydrated when shaken with its saturated aq. solution at 70°, and lower hydrates with 6, 4, 2, and $1H_2O$ are formed successively; solubility data are given for these hydrates at 30—85°. Invariant points at which pairs of the hydrates coexist in contact with the solution occur at 37·9° (7, 6), 48·8° (6, 1), 54·6° (6, 2), and 63·4° (6, $4H_2O$); the corresponding solubilities are 40·8, 43·0, 44·2, and 46·5 wt.-% of $ZnSO_4$, and the densities of the congruent solutions are 1·561, 1·606, 1·627, and 1·662, respectively. A. J. E. W.

Existence of carbamate ion in the reaction of the ammonia-soda process. I. Sodium carbamate–sodium carbonate equilibrium. T. KUKI, S. NIWA, and R. HARA (J. Soc. Chem. Ind. Japan, 1940, **43**, 76—79B).—The systems $NH_2{\cdot}CO_2Na$–H_2O and $NH_2{\cdot}CO_2Na$–NH_3–H_2O have been investigated at 0°, 25°, 50°, and 75°. When different amounts of H_2O are added to a liquid NH_3 solution of NaCl into which CO_2 is passed, stable $NH_2{\cdot}CO_2Na$ is the chief carbonation product over a wide range of H_2O concn. The equilibrium $NH_2{\cdot}CO_2Na + 2H_2O \rightleftharpoons NaHCO_3 + NH_4OH$ has been investigated between 0° and 75° from both directions and over a wide range of $[NH_3]$. The equilibria of both systems are represented for all temp. by a single curve of (mol.-% carbamate/total CO_2) plotted against (wt.-% total NH_3/total NH_3 + H_2O). NH_3 stabilises $NH_2{\cdot}CO_2Na$. W. R. A.

Solid polyiodides of rubidium. H. W. FOOTE and M. FLEISCHER (J. Physical Chem., 1940, **44**, 633—640).—In the system RbI–I–PhMe, RbI_3 is the only binary compound stable at either 6° or 25°. In the system RbI–I–C_6H_6 the ternary *compounds* $RbI_7,4C_6H_6$ and $RbI_8,4C_6H_6$ are also stable phases at both temp. The dissociation pressure of RbI_3 at both temp. has been calc. from the solubilities. J. W. S.

Additive compounds of iodine with alkali bromides and thiocyanates. H. W. FOOTE and M. FLEISCHER (J. Physical Chem., 1940, **44**, 640—646).—Study at 6° of systems comprising an alkali bromide or thiocyanate, I, and C_6H_6 or PhMe indicates that NaBr, KBr, NH_4Br, TlBr, NaCNS, and NH_4CNS form no additive compounds with I. CsBr and KCNS form the *compounds* $CsBrI_2$ and $KCNS,6I,4C_6H_6$, respectively. The dissociation pressure of $CsBrI_2$ at 6° is 0·00486 mm. J. W. S.

Iodides of some multivalent metals. H. W. FOOTE and M. FLEISCHER (J. Physical Chem., 1940, **44**, 647—652).—Studies at 6° of systems comprising FeI_2, CuI, or AgI with I and C_6H_6 or PhMe indicate that FeI_3, CuI_2, and AgI_3 do not exist at this temp. In the systems TlI–I–C_6H_6 and TlI–I–PhMe, however, the *compounds* Tl_6I_8 and TlI_3 are formed, and their dissociation pressures are calc. J. W. S.

Ternary systems ethylene glycol–potassium carbonate–water and dioxan–potassium carbonate–water. K. A. KOBE and J. P. STONG, jun. (J. Physical Chem., 1940, **44**, 629—633).—The solubility of K_2CO_3 in various $(CH_2{\cdot}OH)_2$–H_2O mixtures has been determined at 25° and 40°. The liquid phase remains homogeneous at all concns. at these temp. The solubilities in the system K_2CO_3–dioxan–H_2O have been determined at 0°, 25°, and 40°. Two liquid phases are formed. Of 31 electrolytes tested, 16 salted out dioxan, but none salted out $(CH_2{\cdot}OH)_2$. J. W. S.

Equilibria in the reaction $ZnO + CO \rightleftharpoons Zn_{vapour} + CO_2$. I. M. BODENSTEIN [with W. FALKENBERG] (Z. Elektrochem., 1940, **46**, 132—134; cf. Maier and Ralston, A., 1926, 358).—The equilibrium has been studied by the following method: CO is passed over ZnO at temp. T, and the equilibrium mixture of Zn vapour, CO, and CO_2 is analysed, after cooling, by determination of Zn, ZnO, CO, and CO_2 in the mixture produced by partial reversal of the equilibrium. Log K_p = −5·572 to −1·332 at T = 884—1326° K., where $K_p = p_{Zn} \cdot p_{CO_2}/p_{CO}$. A. J. E. W.

Equilibrium in the reduction of molybdenum dioxide by hydrogen. K. TONOSAKI (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 126—132).—Vals. of K_p (p_{H_2O}/p_{H_2}) determined by a static method at 645—823° for $0{\cdot}5MoO_2 + H_2$ (1 atm.) $\rightleftharpoons$ $0{\cdot}5Mo + H_2O$ (1 atm.) give: $\log K_p = -1444{\cdot}6/T + 0{\cdot}9413$; $\Delta H = 8877 - 3{\cdot}755T + 1{\cdot}47 \times 10^{-3}T^2 + 25150/T$;

$\Delta F^\circ = 8877 + 3{\cdot}755T \log_e T - 1{\cdot}47 \times 10^{-3}T^2 + 12575/T - 31{\cdot}06T$. For $Mo + O_2$ (1 atm.) $\longrightarrow$ MoO_2(s.), $\Delta F^\circ_{298} = -120{\cdot}816$ kg.-cal., $\Delta H_{298} = -131{\cdot}692$ kg.-cal., $\Delta S_{298} = -36{\cdot}5$ g.-cal. per degree, $S^\circ_{298} = 19{\cdot}3$ g.-cal. per degree. Combination with Chipmann's data for the water-gas reaction gives for $0{\cdot}5MoO_2 + CO$ (1 atm.) $\rightleftharpoons$ $0{\cdot}5Mo + CO_2$ (1 atm.); $\Delta F^\circ = -1143 + 3{\cdot}355T \log_e T - 0{\cdot}00327T^2 + 0{\cdot}25 \times 10^{-6}T^3 + 12575/T - 17{\cdot}43T$; $\Delta H_{298} = -1{\cdot}781$ kg.-cal. L. J. J.

Equilibrium in the reduction of molybdenum dioxide by deuterium. K. TONOSAKI (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 133—135; cf. preceding abstract).—Corresponding vals. for reduction by D_2 at 685—845° are given by $\log K_p = 0{\cdot}884 - 1211{\cdot}5/T$. Combination with vals. for H_2 gives for H_2O (g.) + D_2 (g.) $\rightleftharpoons$ H_2 (g.) + D_2O (g.) : $\log K_p = -0{\cdot}0573 + 233{\cdot}1/T$. L. J. J.

Systems copper–nickel–sulphur and copper–nickel–arsenic. W. KÖSTER and W. MULFINGER (Z. Elektrochem., 1940, **46**, 135—141).—Results of a thermal, micrographic, and magnetic study of the systems are used to construct ternary diagrams for the regions Cu–Ni–Cu_2S–Ni_3S_2 and Cu–Ni–Cu_3As–Ni_5As_2. The miscibility gap on the Cu–Cu_2S side is closed with 27% of Ni. Cu_2S and Ni_3S_2 give a quasi-binary system with a eutectic at 705° (Cu 13·3, Ni 60·9, S 25·8%), at which the solid phases are Cu_2S and a β-Ni_3S_2 solid solution containing ~3% of Cu_2S; a eutectoid change, due to the $\beta \rightarrow \alpha$ transition in Ni_3S_2, occurs at 535°. A ternary eutectic occurs close to the Ni_3S_2 corner (Cu 14, Ni 63, S 23%), at 580°; the solid phases are Cu_2S and Cu–Ni and Cu–Ni_3S_2 mixed crystals (α and θ, Cu 20·5, 5; Ni, 79, 70; S 0·5, 25%, respectively). A ternary eutectoid point occurs at Cu 2, Ni 72, S 26%, at which the α phase has Cu 5·5, Ni 94, S 0·5%, and the θ phase becomes nearly pure Ni_3S_2. Sectional diagrams at 5, 10, 15, and 20% of S are given. In the second system, Cu_3As and Ni_5As_2 give a quasi-binary system which has a eutectic (Cu 61, Ni, 9·5, As 29·5%) at 638°; the solid phases are Cu_3As and an extensive series of solid solutions (Cu 56·2, Ni 14·0, As 29·8% at eutectic). The ternary eutectic is at 635°, at which the solid phases are α, θ, and η mixed crystals (Cu 94, 70·5, 57; Ni 1, 2, 14·5; As 5, 27·5, 28·5%). No eutectoid change takes place above room temp. A. J. E. W.

Ternary systems. XXV. Solid solutions of some picromerites at 25°. A. E. HILL, G. S. DURHAM, and J. E. RICCI (J. Amer. Chem. Soc., 1940, **62**, 1031—1036).—Continuous series of solid solutions were found at 25° for the ternary systems $Mg(NH_4)_2(SO_4)_2$–$Cu(NH_4)_2(SO_4)_2$–H_2O; $CuK_2(SO_4)_2$–$NiK_2(SO_4)_2$–H_2O; $CoK_2(SO_4)_2$–$CuK_2(SO_4)_2$–H_2O; $ZnK_2(SO_4)_2$–$CuK_2(SO_4)_2$–H_2O; $ZnK_2(SO_4)_2$–$NiK_2(SO_4)_2$–H_2O; and $Cu(NH_4)_2(SO_4)_2$–$CuK_2(SO_4)_2$–H_2O. All belong to type 1 of Roozeboom's classification. W. R. A.

Heat and free energy of formation of deuterium oxide. F. D. ROSSINI, J. W. KNOWLTON, and H. L. JOHNSTON (J. Res. Nat. Bur. Stand., 1940, **24**, 369—388).—Calorimetric measurements indicate that the ratio of the heats of formation of liquid D_2O and H_2O at 25° and 1 atm. is 1·03068 ± 0·00029 and that the ratio of the heats of vaporisation of these liquids at 25° and zero pressure is 1·03145 ± 0·00075. By combining these results with other data various thermodynamic vals. are calc. Assuming the bond energies in H_2 and D_2 and in H_2O and D_2O to be equal, the difference between the zero point energies of H_2O and D_2O is 3548 ± 22 g.-cal. per g.-mol., in accord with previous observations (A., 1940, I, 146). J. W. S.

Heats of formation of the vanadium oxides V_2O_3, V_2O_4, and V_2O_5. H. SIEMONSEN and H. ULICH (Z. Elektrochem., 1940, **46**, 141—145).—The following heats of formation are obtained by calorimetric measurements (for details of method cf. also A., 1939, I, 524): V_2O_3 296, V_2O_4 342, V_2O_5 373, all ±2 kg.-cal. per g.-mol. at 20°. The following heats of reaction are also obtained: $V_2O_3 + 0{\cdot}5O_2 = V_2O_4 + 46{\cdot}5 \pm 0{\cdot}8$, $V_2O_3 + O_2 = V_2O_5 + 77{\cdot}1 \pm 0{\cdot}5$, $V_2O_4 + 0{\cdot}5O_2 = V_2O_5 + 30{\cdot}6 \pm 0{\cdot}6$ kg.-cal., all at 20°. A. J. E. W.

Heats of formation of calcium aluminates. W. A. ROTH and U. WOLF (Z. Elektrochem., 1940, **46**, 232—233).—The heat of formation of $5CaO,3Al_2O_3$ from corundum and CaO, determined by dissolution in aq. HCl, is −11·1 kg.-cal. per g.-mol. at 20°; the heat of crystallisation is 34·7 kg.-cal. The heat of formation of $3CaO,Al_2O_3$ (cf. Thorvaldson *et al.*, A., 1930, 1524) is corr. to −3·9 kg.-cal., using modern data. (All vals. ±1·5 kg.-cal.) A. J. E. W.

Thermal data. XII. Heats of combustion of carbamide and guanidine carbonate and their standard free energies of formation. H. M. HUFFMAN (J. Amer. Chem. Soc., 1940, **62**, 1009—1011).—Isothermal heats of combustion at 25° of $CO(NH_2)_2$ and guanidine carbonate have been measured calorimetrically and the vals. of ΔG° are −47·21 and −144.34 kg.-cal., respectively. The val. of ΔG° from the third law data is 80 g.-cal < that from equilibrium data. W. R. A.

Active substances. XLIV. Heat content and lattice condition of active nickel. R. FRICKE and W. SCHWECKENDIEK (Z. Elektrochem., 1940, **46**, 90—95; cf. A., 1940, I, 295).—Ni obtained by reduction of $Ni(OH)_2$, "Ni_2O_3," or basic Ni carbonate with H_2 at $\ngtr$235° is pyrophoric, but if reduced at >460° the product is stable in air. The pyrophoric properties are not due to adsorbed H_2, as they are retained after heating in N_2 at 235° for several hr.; they are lost if the container is opened under EtOH and the Ni allowed to dry in air, owing to superficial oxidation, but the Ni is readily ignited by a flame. The heats of dissolution of pyrophoric specimens in aq. HCl–ICl_3 are 0·35—1·75 kg.-cal. per g.-atom > those of stable specimens. *X*-Ray powder photographs show that the difference is due not only to differences in particle size (103—149 and 266 A., respectively), but also to irregular lattice defects and the presence of Ni in the *X*-ray-amorphous form. A. J. E. W.

Heat capacity data for *iso*propyl alcohol vapour. G. S. PARKS and C. H. SHOMATE (J. Chem. Physics, 1940, **8**, 429).—Using a const.-flow method C_p vals. of $Pr^\beta OH$ at 1 atm. pressure have been deter-

mined at 427·9°, 457·7°, and 480·3° K. The data are represented by $C_p = -4{\cdot}54 + 0{\cdot}0767T$, in much better agreement with observed data than vals. calc. from the equation of Fugassi and Rudy (A., 1938, I, 565). W. R. A.

Thermodynamic properties of paraffins and olefines. R. H. EWELL (Ind. Eng. Chem., 1940, **32**, 778—783).—By extrapolation of the entropies and heats of formation of the lower hydrocarbons, rules are derived for calculating these vals. for any paraffin or olefine at 25°. The results are used to calculate the proportions of the various isomeric olefines present at equilibrium at various temp. At 150—175° all isomerides in any group have approx. equal free energy; the more highly branched isomerides are more stable below this temp., whilst the others are more stable above this temp. J. W. S.

Thermodynamic properties of sulphuric acid solutions and their relation to the electromotive force and heat of reaction of the lead storage battery. D. N. CRAIG and G. W. VINAL (J. Res. Nat. Bur. Stand., 1940, **24**, 475—490).—From the partial mol. heat contents of H_2SO_4 solutions of various concns., the heat of the reaction in the Pb accumulator is redetermined and gives good agreement with the vals. derived from electrochemical data. The partial mol. heat capacities and vols. of H_2SO_4 solutions are also recalc. and are used to compute the change in e.m.f. with change of pressure. The results confirm the double sulphate theory of the reaction (B., 1935, 773). J. W. S.

Variation of transference numbers of potassium chloride in aqueous solution with temperature. R. W. ALLGOOD, D. J. LE ROY, and A. R. GORDON (J. Chem. Physics, 1940, **8**, 418—422).—Transference nos. of aq. KCl (0·01—0·10N.) at 15—45° have been measured by the moving-boundary method, using anion and cation boundaries. The Longsworth function $t_+^{0'}$ is linear in the concn. for the whole temp. range, but t_+ decreases with rising temp. in contradiction to the Kohlrausch generalisation. W. R. A.

Decomposition potential of sodium pyrophosphate and niobium pentoxide dissolved in molten phosphate. S. I. SKLJARENKO and O. S. DRUSHININA (J. Appl. Chem. Russ., 1940, **13**, 163—169).—The decomp. potential of $Na_4P_2O_7$ at 1010° is 0·71 v. (temp. coeff. —0·00107 v. per degree); substantially identical results are obtained with 1 : 2 $Na_4P_2O_7$–NaCl and 1 : 2 : 0·2—1·5 $Na_4P_2O_7$–NaCl–Nb_2O_5 mixtures. The anode process is: $P_2O_7'''' \rightarrow P_2O_5 + O_2$; $P_2O_5 + Na_4P_2O_7 \rightarrow 4NaPO_3$, and the cathode process is $Na^{\cdot} \rightarrow Na$; $10Na + Nb_2O_5 \rightarrow 5Na_2O + 2Nb$; $Na_2O + 2Na_4P_2O_7 \rightarrow 2Na_3PO_4$. R. T.

Oxidation–reduction potential of co-enzyme. I. H. BORSOOK (J. Biol. Chem., 1940, **133**, 629—630).—The oxidation–reduction potential at 30° (E_0') of cozymase (diphosphopyridine nucleotide) calc. from thermal data and equilibrium measurements is $-0{\cdot}072 \pm 0{\cdot}0008$ v., the temp. coeff. being —0·00043. ΔF for the reaction $MeCHO + 2H + 2e \rightarrow EtOH$ calc. from this val. of E is in agreement with that calc. from thermal data. A. L.

Action of magnetism on electrolyte solutions. G. DESTRIAU (Compt. rend., 1940, **210**, 697—699).—A p.d. is slowly developed between suitably disposed electrodes in a paramagnetic electrolyte solution exposed to a strong inhomogeneous magnetic field, owing to attraction of paramagnetic ions to regions of higher field strength. With saturated aq. $NiSO_4$ and Ni-plated Cu electrodes in a field of 6500—9500 gauss, the p.d. reaches a max. (60 mv.) in ~1 hr., and falls to 0 2—3 hr. after the field is removed. A. J. E. W.

Hydrogen electrode processes on mercury. A. MITUYA (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 142—147).—Measurements of cathodic current (I) of 10^{-11}—10^{-8} amp. and electrode potential (ψ) on the Hg–H_2 electrode at overvoltages 0·02—0·2 v. give vals. of $\tau = -RT/F\partial \log_e I/\partial\psi = 0{\cdot}3$ and 1·5 for high and low overvoltages, respectively, in agreement with Horiuti and Okamoto's electrochemical mechanism. L. J. J.

Hydrogen and oxygen overvoltages of chromium–nickel alloys in 1-molar potassium hydroxide. M. DE K. THOMPSON and G. H. SISTARE, jun. (Trans. Electrochem. Soc., 1940, **78**, Preprint 4, 47—51).—With increasing [Cr] and for c.d. 0·001—1·0 amp. per sq. cm. the H_2 overvoltage of Cr–Ni alloys decreases to a min. val. between 20 and 30% of Cr and then increases. Only for c.d. 0·0001 amp. per sq. cm. is a continuous increase observed. The plot of log c.d. against overvoltage is approx. linear. There is no connexion between the overvoltage curve and the m.p. diagram. O_2 overvoltages for pure Ni and for alloy containing 10·68% of Cr are recorded. Alloys richer in Cr corrode. C. R. H.

Polarisation in cuprous oxide at low temperatures. II. V. I. LJASCHENKO (Mém. Physique, Kiev, 1940, **8**, 193—195).—The potential jump in a Cu_2O–Cu anode rises linearly with external potential from 0 to 650 v., and then falls. The val. falls with rising temp. from —183° to —90°. R. T.

Peculiarities in the [polarographic] current–voltage curve for europium salt solutions and structure of the solutions. L. HOLLECK (Z. Elektrochem., 1940, **46**, 69—71; cf. A., 1939, I, 338).—Polarographic curves for the reduction of aq. $EuCl_3$ are closely similar in form over a wide concn. range (0·0009—0·18N.), and the diffusion current is approx. const. between the steps in the curve due to the process $Eu^{\cdots} \rightarrow Eu^{\cdot\cdot}$ and the discharge of $Eu^{\cdot\cdot}$. In aq. $Eu(NO_3)_3$, however, the curves for concns. > ~0·03N. develop irregularities in this region, showing that other discharge processes are possible; with low concns. (0·0006N.) the curves resemble those for $EuCl_3$. Parallel differences, ascribed to changes in ion field symmetry in the $Eu(NO_3)_3$ solutions, are observed in the absorption spectra (cf. Freed and Jacobson, A., 1938, I, 620). It is deduced that the additional discharge processes are due to reduction of NO_3', which can reach the cathode in a reducible form only at higher concns., owing to some change in the structure of the solutions. A. J. E. W.

Polarographic studies on complexes in aqueous solution. M. VON STACKELBERG and H. VON FREYHOLD (Z. Elektrochem., 1940, **46**, 120—129).—The

effect of complex formation on reversible oxidation or reduction processes at a dropping Hg electrode is discussed. In certain cases the difference in the nos. of co-ordinated addenda in the oxidised and reduced states and vals. (generally relative) of the dissociation const. of the complex ions can be approx. determined. The essential conditions are complete reversibility of the electrode process (indicated by identical half-wave potentials for oxidation and reduction) and rapid establishment of equilibrium (in $\ngtr$ a fraction of a sec.) at the Hg surface; the co-ordinating group should be present in excess. These limitations are illustrated by data for Zn–C_2O_4 and –OH, Fe–C_2O_4 and –F, and Cu–NH_3 complexes. An approx. quant. agreement with theory is shown by a gradual transition from the simple $Cu^{\cdot\cdot}$/Cu wave to a double $Cu^{\cdot\cdot}/Cu^{\cdot}$–$Cu^{\cdot}$/Cu wave in aq. $Cu(NO_3)_2$ containing increasing amounts of Cl′; the change is due to the existence of $CuCl_2'$ in presence of 0·01—0·1N-Cl′, and the non-existence of a similar $Cu^{\cdot\cdot}$ complex in this concn. range. A. J. E. W.

Electrolytic reduction of aqueous chromic acid solutions. E. MÜLLER (Z. Elektrochem., 1940, **46**, 82—90).—C.d.-*E* curves (*E* = cathode potential referred to normal calomel electrode) for the reduction process are discussed. With pure aq. CrO_3 and a C (graphite) cathode the c.d. rises rapidly to ~13 amp. per sq. dm. (*E* = 0·80—0·50 v.), owing to reduction of CrO_3; *E* then falls abruptly to ~ −1·2 v., evolution of H_2 commences, and reduction ceases because an "*R*-film" of oxide pptd. on the surface by concn.-polarisation effects prevents CrO_3 from reaching the electrode. With a Au cathode *E* falls quickly to ~ −0·6 v., and H_2 evolution (without reduction) sets in; in this case the protective "*F*-film" must be formed by a different mechanism, as no concn.-polarisation can occur. If SO_4'' is present reduction and concn.-polarisation occur at the Au cathode with *E* = 0·4—0 v.; the SO_4'' causes electrochemical dissolution of the *F*-film, and formation of an *R*-film becomes possible. The *R*-film on a C cathode is somewhat sol. in presence of SO_4'', and some reduction takes place simultaneously with the H_2 evolution; with Au this does not occur, as the *R*-film is replaced by an *F*-film as soon as H_2 evolution commences, and SO_4'' is then without effect. With C in presence of SO_4'' the abrupt fall of *E* occurs at a higher c.d. (16 amp. per sq. dm.), and the process oscillates between reduction and H_2 evolution; this can be explained if *F*-films can be formed on parts of the non-uniform C surface. The *R*-film probably consists of Cr_2O_3,CrO_3, and the *F*-film of oriented mols. of $Cr(OH)\cdot CrO_4$ (cf. A., 1939, I, 256). A. J. E. W.

Electrolysis of aqueous sulphurous acid. I. F. IVANEI (J. Appl. Chem. Russ., 1940, **13**, 181—184).—The cathode process is represented: $H_2SO_3 + 4H \rightarrow 3H_2O + S$; $H_2SO_3 + 6H \rightarrow 3H_2O + H_2S$; $2H_2S + SO_2 \rightarrow 2H_2O + 3S$. The yield of H_2SO_4 (anode process) is theoretical, and of S 75—80% (Pt anode, graphite cathode; $[SO_2] = 0{\cdot}5$—1%). R. T.

Graphical methods of kinetic chemistry. J. M. GONZÁLEZ BARREDO (Anal. Fís. Quím., 1939, **35**, 12—14).—The errors observed by Caamaño (A., 1936, 1074) in the author's work (*loc. cit.*) arose from misprints and do not invalidate the formula for *n* in the differential equation $dx/dt = k(a - x)^n t^{p-1}$. F. R. G.

Bivalent nitrogen. I. Rate of dissociation of tetraphenylhydrazine. C. K. CAIN and F. Y. WISELOGLE (J. Amer. Chem. Soc., 1940, **62**, 1163—1169).—The kinetics of the reaction between N_2Ph_4 and NO at 75° and 100° has been studied and a mechanism involving production of free NPh_2 radicals at NO pressures >0·2 atm. is advanced. Solid N_2Ph_4 rapidly decomposes at 100°. In *o*-$C_6H_4Cl_2$, N_2Ph_4 absorbs NO quantitatively and irreversibly to give $NPh_2\cdot NO$ and at 100° the half-life of N_2Ph_4 is 3·1 min. From this the calc. activation energy for the dissociation is 30±1·5 kg.-cal., *i.e.*, 10 kg.-cal. > the energy of dissociation of N_2H_4, calc. from thermochemical data. W. R. A.

Kinetics of cracking of hydrocarbons under pressure.—See B., 1940, 510.

Calculation of weight average mol. wts. during the course of decomposition of homogeneous linear polymerides. W. H. DURFEE and Z. I. KERTESZ (J. Amer. Chem. Soc., 1940, **62**, 1196—1198).—Mathematical. A formula giving the wt. average mol. wt. of a linear polymeride during chain fission has been deduced. This has been employed to calculate the average no. and wt. mol. wt. of a 100-unit polymeride undergoing fission. W. R. A.

Kinetics of isotopic exchange between carbon dioxide, hydrogen carbonate ion, carbonate ion, and water. G. A. MILLS and H. C. UREY (J. Amer. Chem. Soc., 1940, **62**, 1019—1026).—The rates of exchange of C between CO_2 and HCO_3', and of O between CO_2, HCO_3', CO_3'', and H_2O, and the rate of hydration of CO_2, have been investigated using "heavy" isotopes. Exchange between CO_2 and H_2O is due to reversible hydration alone and the energy of activation, between 0° and 25°, is ~16,800±40 g.-cal. O exchange of HCO_3' occurs through formation of CO_2 as a result of hydration at p_H >8 and the rate is unaffected by addition of NaCl or KCl but is accelerated by phosphate buffer. The O exchange of CO_3'' with H_2O is slow but is > for simple hydration of CO_2, possibly because CO_2 reacts with OH′ ions. When the concn. of OH′ ions is high, the exchange is retarded because only small amounts of CO_2 are present. W. R. A.

Kinetics of reaction between potassium persulphate and alkyl iodides. II. M. S. TELANG and V. V. NADKARNY (J. Indian Chem. Soc., 1940, **17**, 219—222; cf. A., 1940, I, 121).—The rate of oxidation of EtI by aq. $K_2S_2O_8$ increases with dilution (*v*) according to the formula $k_v = k_1 + \omega \log v$. In passing from MeI to $Bu^{a}I$ there is a simultaneous decrease of activation energy and of the probability factor, which latter is always <1. *sec.*, *tert.*, and *iso*-iodides are more reactive than the corresponding primary and *n*-compounds. F. L. U.

Binding of sulphurous acid by glucose. F. P. SCHALAIKIN (J. Appl. Chem. Russ., 1940, **13**, 263—266).—The velocity of binding of H_2SO_3 by glucose $\propto$ concn. of substrates. At room temp. the reaction is

slow, equilibrium being attained after 13—25 days, according to the concn. R. T.

Kinetics of the formation of the Grignard reagent. II. Rate of reaction with ethyl bromide. F. C. GZEMSKI and M. KILPATRICK (J. Org. Chem., 1940, **5**, 264—275; cf. A., 1938, II, 224).—Improvement in the methods of studying the rate of dissolution of Mg in $EtBr-Et_2O$ gives uniform and reproducible results; the reaction occurs only at a contact which initiates the change, the rate of which $\propto$ [EtBr]. The nature of the contact does not appreciably alter the velocity coeff. for the substances studied but it alters the yield of MgEtBr in some cases. H. W.

Theory of prototropic and protolytic changes. A. SKRABAL (Z. Elektrochem., 1940, **46**, 146—160).—An attempt to deduce rate expressions for acid- and base-catalysed equilibrium reactions, assuming catalysis to be due to a succession of reactions between the catalyst and the substrate, leads to complex results which agree with the law of additive catalytic activity only in extreme limiting cases. Satisfactory results are obtained if simultaneous reactions are supposed to occur in the substrate and between catalyst and substrate, or if the catalyst merely changes the state of the reacting mols. without influencing the course of the reaction, as in the case of proton exchange (cf. Wegscheider, A., 1900, ii, 532). Both these cases are in accord with Brönsted's relations between catalytic activity and strength of acids and bases. A. J. E. W.

Kinetics of neutralisation. M. KILPATRICK (J. Amer. Chem. Soc., 1940, **62**, 1094—1096).—The neutralisation of the trinitrophenylmethide ion (A., 1939, I, 472) is interpreted as an acid-catalysed reaction. The proposed mechanism explains the observed kinetic data. W. R. A.

Acid-catalysed esterification of aliphatic acids. H. A. SMITH (J. Amer. Chem. Soc., 1940, **62**, 1136—1140).—The rate coeffs., *k*, for the H-catalysed esterification of β-methylvaleric acid (I), $Bu^{\gamma}CO_2H$ (II), and $CHX_2{\cdot}CO_2H$ ($X = Et, Pr^{\alpha}, Bu^{\alpha}, Bu^{\beta}$) have been determined as previously described (A., 1939, I, 206) at 20°, 30°, 40°, and 50°. The rate for (I) $\simeq$ that for $Bu^{\beta}CO_2H$. (II) esterifies slowly, and the remainder very slowly; the activation energies of $CHX_2{\cdot}CO_2H$ are > those of (I) and (II). The results of a simultaneous lengthening of two chains on the esterification velocity of branched-chain acids are parallel with these found when the length of a single chain is increased for *n*-acids (A., 1939, I, 206). A small decrease in *k* occurs on the first Me substitution (< for Et), and little change occurs on further increase in chain length. The results are explained by means of a ring theory. W. R. A.

Inversion of sucrose. L. J. HEIDT and C. B. PURVES (J. Amer. Chem. Soc., 1940, **62**, 1006—1009).—Using a method previously described (A., 1938, I, 362), the rates of inversion of sucrose are slightly > those obtained by the dilatometric method under the same conditions (*loc. cit.*). The activation energy is 25·9 kg.-cal. over the range 0—35°. Log *k* at 0° $\propto$ [HCl] from 0·1 to 4·4N. W. R. A.

Rates of formation of sulphoaliphatic acids. T. F. MURRAY, jun., and W. O. KENYON (J. Amer. Chem. Soc., 1940, **62**, 1230—1233).—The reaction between H_2SO_4 and Ac_2O, $(EtCO)_2O$, and $(Pr^{\alpha}CO)_2O$ in presence of the corresponding acids at 40° yields sulphoaliphatic acids (I). The rate of formation of (I) has been investigated and it is shown that H_2SO_4 disappears according to a first-order equation and its rate of disappearance is related to anhydride concn. Mechanisms for the reaction and for acylation in presence of H_2SO_4 catalyst are proposed. W. R. A.

Organic catalysts. XXI. Activation of organic catalysts. W. LANGENBECK (Z. Elektrochem., 1940, **46**, 106—108; cf. A., 1939, II, 283).—The following general rules for the activation of "covalency catalysts" are enunciated: (*a*) the catalysed change has $\nless$ two component reactions, of which only the slowest need be accelerated by activation. (*b*) Activation is a multiplicative effect, *i.e.*, the effects of activating groups are superposed on one another, and the best combination of such groups can be selected with regard to their successive introduction in the prep. of the catalyst. (*c*) Activating groups must be separated from the catalytically active group only by aromatic nuclei, a double bond, or a conjugated system. (*d*) The most favourable orientation of the activating groups (in "activating positions") cannot be decided empirically, and may vary with external factors. (*e*) A substituent in an activating position may cause inactivation if its effect is < that of H; inactivation may therefore be a criterion of an activating position. (*f*) Substituents fall into two classes, first order (halogen, Me, NH_2, etc.) and second order (CO_2H, NO_2, etc.), apparently corresponding with their orienting effect in the C_6H_6 nucleus; if a first-order group has an inactivating effect, a second-order group will probably activate, and vice versa. Rules (*d*)—(*f*) are illustrated by the action of isatin and its derivatives as dehydrogenases; with basic solvents (C_5H_5N etc.) the catalytic effect of isatin-6-carboxylic acid increases with the proton affinity of the base. A. J. E. W.

Activation of aluminium chloride in the Friedel–Crafts reaction by the catalytic influence of chlorides of elements in the fourth group of the periodic system. E. OTT and W. BRUGGER (Z. Elektrochem., 1940, **46**, 105—106).—The yield of 2-acetyl-1-methyl-Δ^1-*cyclo*pentene obtained from *cyclo*hexane and AcCl in presence of $COMe_2$ by the Friedel–Crafts method (cf. Neninetzcu and Cantuniari, A., 1932, 1132) is increased from <20 to ~50% if the $AlCl_3$ used contains $SnCl_4$, $SiCl_4$, or $TiCl_4$; the optimum effect is obtained with ~1% of $SnCl_4$. The activating action of fourth-group chlorides on $AlCl_3$ has been observed in other similar cases. A. J. E. W.

Influence of the state of order on the heats of reaction of alloy catalysts. A. SCHNEIDER (Z. Elektrochem., 1940, **46**, 321—325).—The heats of activation (*q*) of mixed crystals of $AuCu_3$, $PdCu_3$, and PdCu decrease abruptly as the crystals pass from a disorderly to an orderly state with rise in temp. Further rise in temp. brings about a more gradual

increase in q. In each case the decrease in q, which occurs over a temp. range of approx. 25°, is ~10 kg.-cal. These changes differ from those encountered in the case of AuCu, where an increase in q occurs under similar conditions. This difference in behaviour is also indicated by magnetic susceptibility and elasticity data. C. R. H.

Significance of magnetic condition in the activity of a catalyst. Catalytic decomposition of formic acid on cobalt–palladium alloy in relation to magnetic changes. G. COHN (Svensk Kem. Tidskr., 1940, **52**, 49—64).—The decomp. of HCO_2H over Pd–Co (90 : 10) foil has been studied at 130—180° and 18—28 mm. Hg. The val. of d log k/d(1/T) changes sharply at the Curie interval (152—160°); $Q_{paramagnetic} - Q_{ferromagnetic} = \nless 5$ kg.-cal. but $A_{paramagnetic}/A_{ferromagnetic} = \sim 5$. The results are discussed in relation to structural changes over the Curie interval. M. H. M. A.

Mixed copper–chromium oxide hydrogenation catalysts. V. N. IPATIEV, B. B. CORSON, and J. D. KURBATOV (J. Physical Chem., 1940, **44**, 670—679).—The activity of Cu in catalysing the hydrogenation of C_6H_6 and of *iso*pentene at 225° and 1 atm. is considerably increased by the addition of small amounts of Cr_2O_3. Max. activity is attained with 5% of Cr_2O_3, and further additions lead to a decrease in activity. The activity of either pure Cu or Cu–Cr_2O_3 catalysts is considerably increased by the presence of traces of Ni. All the Cu-containing catalysts caused rapid hydrogenation of *iso*pentene at 100° and 124 atm. Cu prepared by reduction with H_2 under pressure is less active for the hydrogenation of C_2H_4 than is Cu prepared by reduction at atm. pressure of CuO formed by decomp. of the basic carbonate. Reduced Cu is deactivated by heating at 400—500°. J. W. S.

[Non-]effect of ultrasonic vibrations on fused ammonia-synthesis catalyst.—See B., 1940, 524.

Oxidative catalysis in aniline-black dyeing.—See B., 1940, 521.

Cathode processes in electrolysis of solutions of copper salts in presence of selenium dioxide.—See B., 1940, 542.

Polymerisation process in electrical discharges. A. SCHECHTER and K. SIRKINA (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 446—449).—$(CN)_2$ is decomposed rapidly in a condensed spark or silent discharge, yielding N_2 and C, whilst a solid deposit of the composition $C_{2n}N_n$ is formed on the walls of the tube. Formation of this deposit is favoured by a low c.d., and subsequent passage of a discharge through O_2 contained in the vessel coated with the deposit causes its decomp. with production of CO and N_2. The velocity of decomp. of $(CN)_2$ is independent of pressure over the range investigated (0·01—0·6 mm.). J. W. S.

New type of structure-sensitive photochemical phenomenon in crystals. J. A. HEDVALL, P. WALLGREN, and S. MÅNSSON (Svensk Kim. Tidskr., 1940, **52**, 98—101).—CdI_2 crystals in presence of traces of H_2O, illuminated with a Hg arc, show darkening on the faces parallel to the prism axis only. The effect is absent in the absence of H_2O. $CdBr_2$ in the same cryst. form shows a similar effect. $CdCl_2$ and CdF_2 are not affected. The effect is absent in presence of poisons for H_2O adsorption, *e.g.*, C_5H_5N and *o*-$C_6H_4Me{\cdot}NH_2$. The irradiated CdI_2 crystals showed an increased solubility in moist C_6H_6. L. J. J.

Photochemical oxidation of oxalic acid sensitised by ferric ions. R. LIVINGSTON (J. Physical Chem., 1940, **44**, 601—611).—It is confirmed that in the presence of $Fe^{\cdot\cdot\cdot}$ ions and in absence of O_2 the photochemical decomp. of $H_2C_2O_4$ occurs with a quantum yield of ~0·5, whilst in presence of O_2 it has a quantum yield of ~1, and no detectable amount of $Fe^{\cdot\cdot}$ ions is formed (cf. A., 1929, 1023; 1932, 28). Red light, which is absorbed strongly by the solution, does not induce reaction. The thermal oxidation of $Fe^{\cdot\cdot}$ by O_2 does not induce the oxidation of C_2O_4''. Possible mechanisms of the reaction are discussed. J. W. S.

Reactions of ethyl radicals. W. J. MOORE, jun., and H. S. TAYLOR (J. Chem. Physics, 1940, **8**, 396—403).—The photolysis of $ZnEt_2$, and $HgEt_2$ under a variety of conditions has been investigated and the mols.-% of H_2, C_2H_4, C_2H_6, C_4H_{10}, and C_4H_8 in the products have been determined. For ZnEt (45—250°) very little thermal decomp. occurred even at high temp.; Zn was deposited and thus reproducible rate measurements could not be made. In presence of H_2, $ZnEt_2$ yields, at 250°, a trace (<1%) of CH_4, but no CH_4 when H_2 is absent. At lower temp. the amount of $C_2H_4 \simeq$ that of C_2H_6 and $H_2 \simeq C_4H_8$; there is a considerable amount (~20% at 45°) of C_4H_{10} and some higher hydrocarbons. At higher temp. the amount of C_4H_{10} increases whilst the amounts of C_2H_4 and C_2H_6 decrease. At >160° H_2 begins to disappear from the reaction products; C_4H_8 remains const. throughout the temp. range. Above 200° the C_2H_6 increases whilst C_2H_4 decreases but the H : C ratio is maintained const. at 2·5. With $HgEt_2$ thermal decomp. is unimportant even at 250°; much smaller quantities of H_2 are formed than with $ZnEt_2$. C_4H_{10} appears to diminish as temp. increases, and the over-all rate of reaction increases three-fold in the temp. range, suggesting an increased quantum yield with temp. Addition of H_2 gives an increased rate of decomp. with more C_2H_6 and C_4H_{10} formed at lower temp. The effect of H_2 on the products formed under various conditions is discussed. Addition of N_2 or packing the reaction vessel leads to formation of more C_4H_{10}. The primary process involves formation of Et radicals. Combination of two Et radicals, bimolecularly or as a three-body process in the gas phase or at the wall, yields C_4H_{10}. C_2H_6 and C_2H_4 are formed thus: $Et + Et_2Hg(Zn) = C_2H_6 + C_2H_4 + EtHg(Zn)$. Formation of C_4H_8 and H_2 appears to result from surface reactions having different mechanisms for the two metal alkyls. The activation energy of the reaction between Et radicals and H_2 is 9 ± 2 kg.-cal. W. R. A.

Effect of organic reducing agents on corrosion of metals by inorganic reagents.—See B., 1940, 533.

Potentiometric study of complex thiosulphates. Alkaline-earth silver thiosulphates. R.

PORTILLO and J. G. TÁNAGO (Anal. Fís. Quím., 1939, **35**, 15—23).—The *compound* $Ca[Ag_2(S_2O_3)_2],2H_2O$ was obtained similarly to the corresponding Sr salt (A., 1936, 809). F. R. G.

Displacement of chemical equilibrium as an aid to investigating the copper rust reaction. R. SCHENCK and H. KEUTH (Z. Elektrochem., 1940, **46**, 298—308).—The influence of added substances on the v.p. of SO_2 in the reaction $2Cu_2O + Cu_2S \rightleftharpoons 6Cu + SO_2$ has been investigated. Au, Pd, Pt, and Ag, which form alloys or mixed crystals with Cu, increase the v.p. Fe_2O_3, Mn_2O_3, and Cr_2O_3, which react with Cu_2O, reduce the v.p. In this connexion the existence of a phase $4Cu_2O,Cu_2Mn_2O_4$ is reported. The addition of MnS, CoS, and BaS, which form compounds with Cu_2S, should cause a decrease in v.p., but the interpretation of the data is complicated by the reaction between added sulphide and Cu_2O. C. R. H.

Active intermediate states in the combination of oxides and their thermodynamic detection. R. SCHENCK and H. KEUTH (Z. Elektrochem., 1940, **46**, 309—312).—The intermediate formation of $Cu_2Cr_2O_4$ when Cr_2O_3 is introduced into the reaction $2Cu_2O + Cu_2S \rightleftharpoons 6Cu + SO_2$ has been investigated at 700°. A stable phase consisting of a solution of $Cu_2Cr_2O_4$ in Cu_2O, the composition of which lies between $5Cu_2O,Cr_2O_3$ and $4Cu_2O,Cr_2O_3$, has been detected. There is also a more transient Cu_2O–Cr_2O_3 phase which exists at the Cu_2O surface. C. R. H.

Action of water on copper pipes.—See B., 1940, 531.

Effect of the addition of salt vapour on the synthesis and the crystal growth of spinel. T. NODA and M. HASEGAWA (J. Soc. Chem. Ind. Japan, 1940, **43**, 72—73B).—Larger amounts of spinel, MgO,Al_2O_3, are obtained when alkali or alkaline-earth halides are added. The crystal habit is generally octahedral. The efficiencies of different salt series are $LiX > NaX > KX$; $MgX_2 > CaX_2 > SrX_2 > BaX_2$ ($X = F$ or Cl); $M^IF > M^ICl$; $M^{II}F_2 > M^{II}Cl_2$ (M = metal). W. R. A.

Formation of cristobalite and quartz by reheating vitreous silica under high pressure, developed with the aid of explosives. A. MICHEL-LÉVY and J. WYART (Compt. rend., 1940, **210**, 733—734; cf. A., 1939, I, 427).—Quartz (I) is produced by heating vitreous SiO_2 with aq. KOH under a pressure of 3000—4000 kg. per sq. cm. in Ag tubes, at 440—720°, for 4—13 days. With H_2O alone, cristobalite (II) is formed at 545—610°. In a Cu tube (I) is obtained with H_2O at 450—605°, showing that Cu has a mineralising effect; (II) is formed at 720—730°. In a Cu tube with moderate amounts of KOH (I) is produced at 540—585°. A. J. E. W.

Inhibiting action of minute amounts of sodium hexametaphosphate on the precipitation of calcium carbonate from ammoniacal solutions. I. Quantitative studies of the inhibition process. R. F. REITEMEIER and T. F. BUEHRER. **II. Mechanism of the process with special reference to the formation of calcium carbonate crystals.** T. F. BUEHRER and R. F. REITEMEIER (J. Physical Chem., 1940, **44**, 535—551, 552—574).—I. Addition of ~1 p.p.m. of glassy $Na_6P_6O_{18}$ (I) prevents the pptn. of $CaCO_3$ from solutions containing $Ca(HCO_3)_2$ (200 p.p.m.) and NH_3 (550 p.p.m.), whilst cryst. $NaPO_3$ is relatively ineffective. At low $[Ca^{\cdot\cdot}]$, P_2O_7'''' also inhibits the pptn., but the effect of PO_4''' is limited by the pptn. of $Ca_3(PO_4)_2$. No other inorg. salts have this property. The concn. of (I) required to prevent pptn. increases slightly with increasing $[NH_3]$ and considerably with increasing $[Ca(HCO_3)_2]$. NH_4 salts and neutral Na salts increase the efficiency of (I), suggesting an indirect effect on the activities of the $Ca^{\cdot\cdot}$ and HCO_3' ions and of NH_4OH.

II. Ultramicroscopic studies of the pptn. of $CaCO_3$ in presence of (I) indicate that the $CaCO_3$ does not pass into a colloidal state and that such a state is not stabilised by (I), but it promotes the formation of larger and more distorted calcite crystals. At concns. of (I) >0·6 p.p.m. the (I) is adsorbed by the $CaCO_3$ in such a way that the Ca : P ratio is ~300. The inhibition is considered to involve a restricted or deranged crystallisation due to the adsorption of (I) on the crystal faces. Cryst. $NaPO_3$ acquires the property of inhibiting pptn. of $CaCO_3$ in presence of KOH. J. W. S.

Reaction of boron fluoride with aluminium chloride or bromide. E. L. GAMBLE, P. GILMONT, and J. F. STIFF (J. Amer. Chem. Soc., 1940, **62**, 1257—1258).—By the action of BF_3 on $AlCl_3$ or $AlBr_3$, under described conditions, BCl_3 or BBr_3 can be prepared. They are also prepared when fluoborate reacts with $AlCl_3$ or $AlBr_3$. BF_3 reacts with AlI_3 to give BI_3 in small yield. No fluochlorides or fluobromides of B have been isolated. W. R. A.

Effect of the addition of salts on the crystal growth of alumina. T. NODA and Y. ISIHARA (J. Soc. Chem. Ind. Japan, 1940, **43**, 71—72B).—$Al(OH)_3$ calcined at 1000° gave γ-Al_2O_3 which was converted into α-Al_2O_3 by heating at 1300°. The crystal growth is accelerated by addition of vapours of various halides. The efficiency is in the order $NaF > KF > LiF$. Hexagonal plates were obtained when NaF and KF were used, whereas LiF gave a mixture of needles or columns and granular polyhedra. Alkali chlorides are less efficient than the corresponding fluorides, and $NaCl > KCl > LiCl$; NaCl and KCl gave hexagonal plates. For other series the efficiencies are $CaF_2 > MgF_2 \gg SrF_2$ and BaF_2; $MgCl_2 > CaCl_2$ and $SrCl_2 \gg BaCl_2$. W. R. A.

Rapid means of obtaining manganese-free iron. T. W. RAY (J. Lab. clin. Med., 1940, **25**, 745—747).—A procedure for removing sol. Mn salts from Fe by a special means of pptn. and by removing the washings by centrifuging rather than by filtration, is described. C. J. C. B.

Preparation of cobalt carbonyl, cobalt nitrosyl carbonyl, and cobalt carbonyl hydride by the cyanide method. A. A. BLANCHARD and P. GILMONT (J. Amer. Chem. Soc., 1940, **62**, 1192—1193).—If a small amount of a carrier, a cyanide or cysteine, is present CO is absorbed quantitatively by an alkaline suspension of a Co salt to form $KCo(CO)_4$ thus: $2CoCl_2 + 11CO + 12KOH = 3K_2CO_3 + 2KCo(CO)_4$ (I) $+ 4KCl + 6H_2O$. When the carrier is absent no absorption of CO occurs. The carrier causes

intermediate formation of volatile $HCo(CO)_4$ (II), which is liberated from (I) by acids. With NO (I) gives $Co(CO)_3NO$ according to: $KCo(CO)_4 + NO + H_2O \rightarrow Co(CO)_3NO + CO + KOH + 0{\cdot}5H_2$. Spontaneous decomp. of (II) at room temp. yields $[Co(CO)_4]_2$. W. R. A.

Spectrophotometry in analytical chemical research. M. G. MELLON (Proc. VII Conf. Spectros., 1939, 101—106; cf. A., 1937, I, 201).—Qual. and quant. applications are described. O. D. S.

p_H values of salts as an aid to their identification. N. A. TANANAEV and J. V. KARJAKIN (J. Appl. Chem. Russ., 1940, **13**, 304—308).—The p_H of solutions of Na salts of weak acids are in certain cases characteristic of the given salts, and may serve for their identification. R. T.

Determination by photo-electric methods. II. A. DEL CAMPO, F. BURRIEL, and L. G. ESCOLAR (Anal. Fis. Quim., 1939, **35**, 41—44).—The method previously described (A., 1937, I, 199) is used for the determination of I′ and Br′, separately or together. In presence of each other, I′ can be determined; owing to the difference in solubility of AgI and AgBr, pptn. of AgI is completed first and the end-point is indicated by a movement of the ammeter needle. F. R. G.

Determination of nitrogen in iron and steel.—See B., 1940, 530.

Determination of silicon in fluorspar or cryolite.—See B., 1940, 524.

[Analysis of] cyanide plating solutions.—See B., 1940, 536.

Gravimetric determination of sodium in natural waters with zinc uranyl acetate. O. OPARINA (Hydrochem. Mat. 1939, **11**, 96—103).—The accuracy attainable in the determination of Na in aq. NaCl by the Zn uranyl acetate method has been determined. The error involved in the determination of Na in natural waters without previous removal of Ca and Mg is $\not>$ that in the determination in aq. NaCl. R. C.

Modification of the iodate method for determining barium. F. C. GUTHRIE (J.S.C.I., 1940, **59**, 98).—The volumetric determination of Ba after pptn. as $Ba(IO_3)_2$ (A., 1939, I, 98) has been modified to avoid error due to loss of the ppt. during washing. The Ba is pptd. by adding a measured vol. of aq. KIO_3, the mixture is made up to known vol., and excess of KIO_3 is determined in an aliquot of the filtered solution by means of $Na_2S_2O_3$.

Coprecipitation of barium ion with hydrous aluminium, chromic, and ferric oxides in the presence of ammonium ion. L. LEHRMAN, J. BEEN, and M. MANES (J. Amer. Chem. Soc., 1940, **62**, 1014—1018).—The loss of $Ba^{\cdot\cdot}$ when hydrous Al_2O_3, Cr_2O_3, and Fe_2O_3 are pptd. by aq. NH_3 in presence of NH_4 salts is attributed partly to surface adsorption and not to the formation of $BaCO_3$; $NH_4^{\cdot}$ partly replaces $Ba^{\cdot\cdot}$ in the adsorption. Occlusion of $Ba^{\cdot\cdot}$ occurs with Al_2O_3, Cr_2O_3, and Fe_2O_3 but when large amounts of oxides are pptd. the surfaces are not saturated with $Ba^{\cdot\cdot}$. Al_2O_3 and Cr_2O_3 cause post-pptn. of $Ba^{\cdot\cdot}$. W. R. A.

Determination of zinc in transparent rubber articles.—See B., 1940, 552.

Determination of lead in ethyl petrol.—See B., 1940, 511.

Determination of lead in metal coatings.—See B., 1940, 532.

Flotational reaction for aluminium. I. M. KORENMAN (J. Appl. Chem. Russ., 1940, **13**, 309—310).—5 ml. of solution are made alkaline with aq. NH_3, acid with AcOH, and 2—3 ml. of buffer solution (p_H 4·5—5·5) are added, followed by 3—4 drops of conc. aluminon solution. The mixture is shaken with 1 ml. of $CHCl_3$, when a red film forms at the phase interface in presence of 0·05—0·1 mg. of Al; Fe^{II}, Co^{II}, Zn, Ni^{II}, and Mn^{II} do not interfere, except in very large excess. R. T.

Determination of manganese and magnesium in aluminium alloys.—See B., 1940, 535.

Volumetric determination of ferric iron. F. R. BRADBURY and E. G. EDWARDS (J.S.C.I., 1940, **59**, 96—98).—$Fe^{\cdot\cdot\cdot}$ may be determined directly by titration with $HgNO_3$ in presence of excess of NH_4CNS. $Fe^{\cdot\cdot}$ or total Fe can be determined by titrating the solution resulting from $KMnO_4$ titration. The $[NH_4CNS]$ must be $\not>10$ equivs. per equiv. of $Fe^{\cdot\cdot\cdot}$. In presence of HCl more conc. than 0·1N. results are 1—2% high.

Conductometric analysis of chrome-tanning liquors.—See B., 1940, 554.

Influence of extraneous elements on the intensity ratio of line pairs used in quantitative analysis. II. W. R. BRODE and J. L. APPLETON (Proc. VII Conf. Spectros., 1939, 36—41).—The variation with concn. of Pb and Mg and of extraneous elements, Sn, Bi, Sb, Cu, Cd, Ni, and Zn, of the intensity ratio of Pb and Mg line pairs has been investigated. Intensity ratios of the Pb line 2833·07 are the least influenced by concn. and by extraneous elements. The effect of concn. on intensity ratios is small in the presence of Cu. O. D. S.

Mercury recording thermometer for use over long periods of time. L. O. COOK (J. Sci. Instr., 1940, **17**, 161—162).—The shadow of a flat-section Hg column of a thermometer is cast on to a drum of bromide paper, which is rotated at intervals by a relay, worked through an intermediate Hg switch from contacts on a mains-driven clock. D. F. R.

Temperature gradient control in crystallisation from the melt. D. C. STOCKBARGER (Rev. Sci. Instr., 1939, **10**, 205—211; cf. A., 1938, I, 409).—A thermo-couple in the furnace windings operates a galvanometer the mirror of which deflects a beam of 2-phase 60-cycle modulated light through a phase selector on a photo-electric cell. The output from the cell, after amplification, energises the field of a motor of which the armature is connected to 60-cycle a.c., so that the direction of deflexion of the galvano-

meter determines the direction of rotation of the motor. The motor drives heavy rheostats controlling the heating power of the furnace. A safety release in the gear train from the motor to the rheostats guards against the motor accidentally running continuously in one direction. D. F. R.

Determination of the heat evolution of reactions at high temperature and pressure. A. Léopold (Compt. rend., 1940, **210**, 672—674).—A method of following the heat effect of degrading hydrogenation and similar composite reactions is outlined. A curve obtained by plotting the heat evolved or absorbed against time can be resolved into "reaction zones," each consisting of a consecutive max. and min., which correspond with the successive stages of the reaction; the heat effect of each stage can be deduced, and the process can be suitably interrupted to determine the character of each reaction involved. Typical curves for the hydrogenation of tetrahydronaphthalene are given. A. J. E. W.

Spectrographic analysis. I. Equipment, technique, and applications of spectrographic analysis in the [New Zealand] Dominion laboratory. S. H. Wilson (New Zealand J. Sci. Tech., 1940, **21**, B, 225—240).—In an account of the lay-out and equipment of the laboratory the advantages and disadvantages of spectrographic analysis are discussed, particularly with reference to general and routine work. The spectrographic method may not result in any time-saving unless qual. results are sufficient, but its principal advantages are its ability to detect many elements in one sample at the same time and the permanent nature of the spectrogram. C. R. H.

Spectrographic analysis at the U.S. naval torpedo station. A. Mankowich (Proc. VII Conf. Spectros., 1939, 19—23).—Laboratory practice is described. O. D. S.

Prism versus grating for spectrochemical analysis. M. Slavin (Proc. VII Conf. Spectros., 1939, 51—58).—The grating spectrograph is superior to the prism spectrograph for qual. analysis owing to its high resolving power in the visible and near infra-red. For quant. analysis a grating spectrograph corr. for astigmatism by Sirks' method is superior for elements of which the principal lines lie at $\lambda\lambda > 3600$, and can be used for all analyses. O. D. S.

Spectroscopic suggestions. W. F. Meggers (Proc. VII Conf. Spectros., 1939, 73—75).—The importance, for line identification, of a narrow slit and of exact λ determination by the use of the Hartmann dispersion formula in prism spectrography is emphasised. O. D. S.

Testing and use of concave diffraction gratings. G. R. Harrison (Proc. VII Conf. Spectros., 1939, 59—64).—Methods of selecting, mounting, and testing gratings are described. O. D. S.

Recording microphotometer. R. C. Machler (Proc. VII Conf. Spectros., 1939, 65—67).—A development of the instrument of Knorr and Albers (A., 1937, I, 427). O. D. S.

Rapid spectrum line photometer. W. A. Kerr (Proc. VII Conf. Spectros., 1939, 68—72).—Apparatus is described. O. D. S.

Ultra-violet photo-electric spectrophotometer. D. L. Drabkin (Proc. VII Conf. Spectros., 1939, 85—90).—The light source and amplifier system are described in detail. O. D. S.

Use of the spectrograph and densitometer for spectrophotometry and colorimetry. A. E. Ruehle and E. K. Jaycox (Proc. VII Conf. Spectros., 1939, 98—100).—Absorption is measured directly by comparison of the photographic densities of the spectra of the solution and pure solvent. By this method the absorption curve of K_2CrO_4 (Int. Crit. Tables) has been reproduced to $\pm 3\%$ and Bi determined as BiI_3,xKI to $\pm 6\%$. O. D. S.

Fundamental features of the photographic process and their special manifestation in quantitative spectrochemical methods. L. W. Strock (Proc. VII Conf. Spectros., 1939, 134—141).—Theoretical. The influence of reciprocity failure, intensity retardation of development, the Eberhard effect, and the fog effect on the log concn.–log exposure time curve is discussed. O. D. S.

Luminous universal X-ray spectrograph of high resolving power. E. Ingelstam (Rev. Sci. Instr., 1940, **11**, 160—164).—Internal and external reflexions from the ($\bar{4}130$) and ($13\bar{4}0$) planes respectively of a curved quartz crystal have been employed in a spectrograph covering the range 0—2·300 A. The aperture of the instrument is 65° and by calibrating the film (sensitised on one side only) direct λ reading is possible. Rapid adjustment is facilitated by aligning indexes on two screens of fluorescent material. Technical improvements in the crystal holder have been made. T. H. G.

New form of Sauter X-ray goniometer. D. E. Thomas (J. Sci. Instr., 1940, **17**, 141—149).—The necessary synchronism between the rotations of the crystal and film is obtained with two synchronous a.c. motors. The film can be used normal to the incident X-rays or inclined at an angle to intercept the more deviated reflected rays. In both these film positions equatorial and layer line reflexions can be obtained. D. F. R.

Polarising comparison-microscope for use in petrographic measurements. G. T. Faust (U.S. Bur. Mines, Rept. Invest. 3503, 1940, 7 pp.).—The use of such a microscope for investigating separated fractions of minerals, coal, and ceramic materials is described and illustrated. L. S. T.

Mechanism of the combustion of methane. L. Coppens (Bull. Acad. roy. Belg., 1939, [v], **25**, 530—535).—In view of the supposed formation of CH_2O as an intermediate product, an apparatus for investigating the ultra-violet absorption spectrum during the process of slow partial combustion of CH_4 is described. Results show conclusively the presence of CH_2O. Causes of the presence of H_2 in the products of partial combustion are discussed. N. M. B.

New method for investigating the refractive index and thickness of thin interference films on

glass. A. Vašiček (Physical Rev., 1940, [ii], **57**, 925—931; cf. A., 1939, I, 256; Blodgett, *ibid.*, 238).—The method described depends on the special condition under which light reflected by the film is plane polarised. Results of measurements are tabulated. N. M. B.

Problems of light excitation in spark sources. H. Kaiser (Proc. VII Conf. Spectros., 1939, 77—81).—Subjects discussed are: the electrical nature of the spark, the production of uniform sparks, irregular types of discharge, distribution of spark strokes over the electrode surface, action of the spark on the electrodes, light excitation in vapour clouds, cooling of vapour clouds, and the influence of surface structure on vapour projection. O. D. S.

Pulsating direct current arc discharges. J. Schuch (Proc. VII Conf. Spectros., 1939, 82—84).—The variation at different phases of a pulsating d.c. Fe arc of the intensity ratio with respect to Fe of the spectra of impurities (Si, Ni, Cr, Mn, and V) present in small traces has been investigated by means of a synchronised rotating aperture run off the same a.c. source as that supplying the full-wave vac. rectifier. In some cases enhancement by a factor of 23 was observed. The degree of enhancement varies greatly with phase angle, the best all-round enhancement being obtained at an angle $\sim 60°$. O. D. S.

Electrodeless measurement of electrical resistance of metals and alloys at high temperature. I. Electrical resistance of manganese. G. Grube and H. Speidel (Z. Elektrochem., 1940, **46**, 233—242).—Two methods for the determination of sp. resistance, ρ, are described; one is an a.c. bridge method depending on eddy currents, and the other a torsion method in which ρ is measured by the couple exerted on a cylindrical specimen by a rotating magnetic field. Vals. of ρ for Mn at 20—1300° ($2 \cdot 6 \times 10^{-4}$ Ω. at 20°) are recorded; $d\rho/dT$ is positive up to 660°, but negative from 660° to the α–β transition point, 740°, at which ρ falls from $3 \cdot 1$ to $1 \cdot 6 \times 10^{-4}\,\Omega$.; β-Mn can be supercooled to 610°. β-, γ-, and δ-Mn all have negative vals. of $d\rho/dT$, and each transformation, including melting, is accompanied by a fall in ρ ($1 \cdot 05$—$0 \cdot 8$, $0 \cdot 75$—$0 \cdot 70$, $0 \cdot 70$—$0 \cdot 40 \times 10^{-4}\,\Omega$.). A. J. E. W.

Electron counter with an aluminium cathode. P. G. Borzjak and J. I. Kovalenko (Mém. Physique, Kiev, 1940, **8**, 197—204).—An electron counter, with a borate-Li-Be glass window and an Al cathode, described, is used to measure the work function of the thermo-electron, at 20—145°; this is $\phi = 0 \cdot 57$ v. at 80—145°, and $0 \cdot 12$ v. at 23—63°. The results are not in conformity with any known theory of the nature of emission centres. R. T.

Technique of high-intensity bombardment with fast particles. F. N. D. Kurie (Rev. Sci. Instr., 1939, **10**, 199—205).—In order to protect the cyclotron chamber from the spattering of non-refractory targets under high-intensity bombardment, the target is placed on a H_2O-cooled Cu holder in a small rectangular bombardment chamber, filled with H_2 or He at a low pressure, and separated from the cyclotron chamber by a metal window 0·0001—0·001 in. thick. The window is supported on a grid of elongated holes, having a geometrical aperture of 93%. D. F. R.

Engineering and atomic transmutation. J. D. Cockcroft (J. Inst. Metals, 1940, **66**, 141—148).—A lecture. The construction of the cyclotron at the Cavendish Laboratory and its use in producing intense sources of the radioactive forms of the elements are described and some applications of these radioactive elements in biology and metallurgy are discussed. A. R. P.

Completely portable radioactivity meter requiring no high-voltage battery. H. F. Kaiser (Rev. Sci. Instr., 1939, **10**, 218—219).—A simple valve oscillator and rectifier, employing a small 135-v. wireless battery, gives a source of 1400 v. d.c. and is used in conjunction with a multi-vibrator, Ne tube coupled circuit recently proposed by Johnson (A., 1938, I, 478). D. F. R.

Opening a tube in vacuum. J. J. Brady (Rev. Sci. Instr., 1940, **11**, 181).—The seal of the tube to be opened is connected by vac. wax to a subsidiary evacuable system. The latter contains a heated hairpin of fine W wire welded between thicker W leads and flexible Cu spirals. The bend of the hairpin is connected to an electromagnetically controlled plunger by means of which it can, when white hot, be caused to touch and soften the seal to be opened. By highly evacuating the subsidiary system oxidation of the contents of the experimental tube after opening is prevented. T. H. G.

Admission of pure gases to vacuum systems. E. L. Jossem (Rev. Sci. Instr., 1940, **11**, 164—166).—The diffusion of H_2, D_2, N_2, O_2, and CO through metals and of He and Ne through SiO_2 is reviewed. An apparatus which permits a const. flow of gas into an experimental vac. system is described. A closed tube of a suitable metal or of SiO_2 serves as a semipermeable membrane and is sealed to the experimental system either directly or via a Pt thimble sealed to the glass. Admission of gas is controlled by a coil of wire surrounding the metal tube. T. H. G.

Elementary processes in dust and fog filtration. H. Witzmann (Z. Elektrochem., 1940, **46**, 313—321).—The laws of aërosol filtration have been studied with the aid of experiments with Sudan-red G fogs and filters of known characteristics. Data for multilayer filters of cellulose and artificial silk show that the amount of aërosol removed at any one layer $\propto$ the concn. at the layer. The absorptive powers of several paper, stone, and sintered glass filters of varying porosities have similarly been examined. The mathematical theory of dust removal by sedimentation, centrifuging, etc. is applied to aërosol filtration. The laws governing the dry filtration of aërosols and those governing filtration of liquid suspensions are fundamentally the same. C. R. H.

Separation of alloys and isotopes by the centrifuge. H. C. Pollock (Physical Rev., 1940, [ii], **57**, 935—936).—The partial separation of the constituents of liquid Wood's metal, involving a density change of 13%, is described. The separation of isotopes in a liquid seems to be negatived by the slowness of

mol. sedimentation. The separation of Cl isotopes by the evaporative centrifuging (cf. Humphreys, A., 1940, I, 36) of HCl just above its m.p., or of CCl_4 is discussed. N. M. B.

Thermal separation of isotopes. W. W. WATSON (Physical Rev., 1940, [ii], **57**, 899—902; cf. A., 1940, I, 35).—The performance and separation efficiency of a simple multi-stage apparatus for various arrangement of coupling are discussed with reference to data obtained for CH_4–N_2 mixture separation, concn. of ^{13}C, and ^{22}Ne–^{20}Ne separation. Results are in agreement with the Furry–Jones–Onsager theory (cf. A., 1939, I, 395). N. M. B.

Attainment of high hydrostatic pressures. R. W. GORANSON and E. A. JOHNSON (Physical Rev., 1940, [ii], **57**, 845; cf. A., 1940, I, 247).—Pressures >200,000 atm. were obtained in the second-stage cylinder of a two-stage cascaded pressure apparatus. Piston displacement measurements indicated that NaCl was compressed >20% (probably ~30%). The initial vol. compressibility to 10,000 atm. was $4{\cdot}2 \times 10^{-6}$, according with the accepted val. N. M. B.

Sensitive static vapour pressure apparatus. R. C. CHANDLER (J. Physical Chem., 1940, **44**, 574—583).—The apparatus comprises a differential tensimeter, the solution bulbs being immersed in a thermostat whilst the lower portion of the manometer contains a liquid piston which actuates a mirror arranged so as to measure changes in the level of the liquid with a sensitivity corresponding with a change in v.p. of $<10^{-4}$ mm. The methods of temp. control and the calibration and operation of the apparatus are described in detail. J. W. S.

Efficiency of fractionating columns.—See B., 1940, 504.

Geochemistry.

Measurement of the rate of exchange of oxygen between a water basin and the atmosphere. G. VINBERG (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 666—669).—A method for analysing diurnal fluctuations of $[O_2]$ in the H_2O of lakes, ponds, etc. is described. F. J. G.

Hydrochemical regime of the ice-covered Volga river in connexion with the death of fish observed during winter 1939. B. A. SKOPINTZEV (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 670—673).—Examination of recorded analytical data suggests that O_2-deficiency in the H_2O of the Volga during winter is not due to oxidation of org. matter but to feeding by underground instead of by surface H_2O. F. J. G.

Diurnal variation in dissolved oxygen and p_H of natural water basins. B. A. SKOPINTZEV (Hydrochem. Mat., 1939, **11**, 112—119).—In two cases studied the intensity of biochemical processes, *i.e.*, the sum of photosynthetic and oxidative processes, in samples of the H_2O contained in submerged bottles differed from that in the free H_2O. The discrepancy is ascribed to the vertical migration of zooplankton, to the vertical movement of surface layers of H_2O cooled during the night, to diffusion of O_2 from the H_2O into the air, and to fixed water-plants. R. C.

Geochemical characteristics of mineral waters of Northern Urals. V. M. LEVTSCHENKO (Hydrochem. Mat., 1939, **11**, 190—204).—The genesis of the various waters is discussed in relation to the solubility of gypsum (I) and $CaCO_3$ in aq. NaCl, and to the activity of SO_4''-reducing bacteria. The solubility of (I) in 0—4M-NaCl at 25° is recorded. R. C.

Chemical composition of Abastuman hot springs. V. M. LEVTSCHENKO (Hydrochem. Mat., 1939, **11**, 205—210).—Analyses have been made and the activities of the various dissolved ions calc. R. C.

Metamorphosis of salt lakes. V. V. EPSTEIN (Hydrochem. Mat., 1939, **11**, 211—231).—Owing to the solonetz soil of the West Siberian Plain the ground H_2O contains Na_2CO_3 and most salt-lakes are very alkaline. Thus the accumulation of alkaline earths, which are pptd. as carbonates, is prevented; deposition of gypsum (I) is impossible. Only in lakes fed by hard ground H_2O do alkaline-earth cations accumulate and is (I) pptd. A classification of salt-lakes is based on these observations. R. C.

Soljony Liman. E. S. BURKSER, E. J. KITAER, and M. M. FUCHS (Hydrochem. Mat., 1939, **11**, 244—254).—A hydrochemical study of the lake. R. C.

Manganese content of ore-mine waters. I. P. NOVOCHATSKI and S. K. KALININ (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 652—654).—Ore-mine waters contain 0·2—16·0 mg. per l. of Mn, representing 0·018—3·16% of the solid residue. F. J. G.

Chemistry of ore-mine waters according to spectroscopic analysis. I. P. NOVOCHATSKI and S. K. KALININ (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 655—658).—Results of chemical and spectroscopic analyses are given. F. J. G.

Effect of bottom deposits on the chemistry of fresh-water basins. S. V. BRUEVITSCH, R. M. PEVSNJAK, V. L. PONIZOVSKAJA, and M. A. SIBIRJAKOV (Hydrochem. Mat., 1939, **11**, 131—168).—Analyses of the H_2O and the solution expressed from the ooze in Lake Bisserovo at various depths have shown a considerable accumulation of biogenic elements, other than O and nitrates, in the ooze solution as compared with the H_2O on the bottom of the lake. The distribution of the elements varies considerably with the season, and especially during the mixing of the H_2O in spring considerable amounts pass from the ooze into the H_2O. R. C.

Physicochemical investigation of Achtal muds. E. S. BURKSER and V. V. BURKSER (Hydrochem. Mat., 1939, **11**, 232—243).—The high content of $MgCO_3$ and $CaCO_3$ and absence of sulphates suggest that the carbonates were formed by biochemical reduction of sulphates, the S being removed by petroleum. The dried mud recovers its original properties on moistening with H_2O. R. C.

Achtal volcanic mud. V. M. Levtschenko (Hydrochem. Mat., 1939, **11**, 177—189).—Mud used for therapeutic purposes has been analysed. It has marked colloidal properties, due to a high clay content. It has probably been formed by the leaching action of salt H_2O. R. C.

Structure of meteoric iron. E. A. Owen (Phil. Mag., 1940, [vii], **29**, 553—567).—The distribution of plessite, kamacite, and taenite shown by the Widmanstätten figures of meteoric Fe–Ni is in agreement with the view that the γ phase existing at high temp. is transformed directly on rapid cooling into a metastable (α_2) form, which gives an equilibrium mixture of α and γ phases on annealing at relatively low temp. L. J. J.

Recrystallisation of magnesia. H. G. Schurecht and V. D. Fréchette (J. Amer. Ceram. Soc., 1940, **23**, 134—136).—X-Ray studies of several magnesites calcined at 800—1400° showed that the lightly calcined mineral was crypto-cryst. with a periclase structure and that " dead burning " merely increased the crystal size. J. A. S.

White tantalite. A. E. Williams (Chem. Eng. Min. Rev., 1940, **32**, 239).—Partly rounded, resinous, prismatic crystals of manganotantalite of greyish-white colour occur sparingly in the alluvial deposits of the Finnis River, Northern Territory, Australia. They have d 6·37, contain Ta_2O_5 48·44, Nb_2O_5 33·10, FeO 1·26, MnO 16·12, and $(Ce,Zr)O_2$ 0·82, and show loss on ignition 0·24%. A. R. P.

Kasolite. H. Brasseur (Bull. Acad. roy. Belg., 1939, [v], **25**, 654—659).—Kasolite (I) has (X-rays) a_0 13·22, b_0 7·04, c_0 6·81 A., β 76° 21′ giving $a_0 : b_0 : c_0$ 1·878 : 1 : 0·967 in agreement with new goniometric measurements. The formula of (I) is UO_3,PbO,SiO_2,H_2O, with 4 mols. per unit cell and $\rho_{calc.}$ 6·256. L. S. T.

Distribution of heavy accessory minerals in a laccolith. E. C. Dapples (Amer. J. Sci., 1940, **238**, 439—450).—Mineral analyses for the Mt. Wheatstone, Colorado, laccolith are recorded and discussed. The zircon (I) content is characteristically low. (I), sphene, and apatite are not uniformly distributed throughout the igneous body. L. S. T.

Maucherite (nickel-speiss, placodine, temiskamite). M. A. Peacock (Min. Mag., 1940, **25**, 557—572).—Maucherite and temiskamite are shown to be identical with Ni-speiss, a by-product in the manufacture of smalt. Analysis of material from Sudbury, Ontario, gave Ni 49·96, Co 0·20, Fe 0·84, Cu 0·69, As 45·88, S 0·97, H_2O 0·36, gangue 0·32, total 99·22; d 8·00; and from Eisleben in Thuringia Ni 50·03, Co 0·84, Fe trace, Cu 0·13, As 45·90, S 0·18, gangue 1·66, total 98·74; d 7·83. It forms radially fibrous or granular aggregates, platinum-grey in colour with a reddish tinge. Crystals are tetragonal, and the unit cell of dimensions a 6·844, c 21·83 A. contains $Ni_{44}As_{32} = 16Ni_3As_2 - 4Ni$, there being four vacant Ni positions in the structure. L. J. S.

Iron-rich kornerupine from Port Shepstone, Natal. J. E. de Villiers (Min. Mag., 1940, **25**, 550—556).—Rough orthorhombic ($a : c = 0·854 : 1$) crystals of greyish kornerupine, associated with biotite, tourmaline, and grandidierite, have d 3·445, H $6\frac{1}{2}$, α 1·682, β 1·698, γ 1·699, and gave on analysis SiO_2 29·53, B_2O_3 3·5, Al_2O_3 40·97, Fe_2O_3 11·66, FeO 1·72, MnO 0·08, MgO 10·90, Na_2O 0·70, TiO_2 0·44, P_2O_5 0·12, H_2O+ 0·67 = 100·29. The unit cell (A., 1929, 1223, prismatine) contains $(R'''_2,R''_3,R'_6)_3(Si_3,B_4)O_{15}$. L. J. S.

Composite dike at Brockhill, Worcestershire. J. H. Taylor (Min. Mag., 1940, **25**, 538—549).—A small dike consists of teschenite (detailed chemical analysis given) with narrow margins of quartz-dolerite. The latter has evidently resulted from reaction of the teschenitic magma with the intruded sediments. The adjacent marls have been converted into hornfels. L. J. S.

Reversible photosensitivity in artificial materials containing rutile. W. O. Williamson (Min. Mag., 1940, **25**, 513—528).—TiO_2 (as finely divided anatase), after heat-treatment with Fe or Mn salts (0·40—1·00% Fe_2O_3) with conversion into rutile, rapidly becomes brown on exposure to daylight, this colour fading again in the dark. The photosensitivity is held to depend on the entry of impurities into the rutile crystals. L. J. S.

Conglomerates and lavas in the Singhbhum–Orissa iron ore series. F. G. Percival and E. Spencer (Trans. Min. Geol. Met. Inst. India, 1940, **35**, 343—364).—Characteristics and occurrences of the conglomerates and of the lava and ash beds are described. Chemical analyses [P. B. Gupta] of two dolerites and two lavas are recorded. L. S. T.

Geology of the Searchlight district, Clark County, Nevada. E. Callaghan (U.S. Geol. Survey, 1939, Bull. 906–D, 135—188).—Rock types, mineral deposits, mines, and prospects are described. L. S. T.

Quantitative mineralogical analysis applicable to nepheline syenites and other nepheline-bearing rocks. M. Dorfman (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 453—455).—A smoothed surface of the specimen, preferably perpendicular to the direction of mineral flow, is immersed for 5—7 hr. in 5% HNO_3, which dissolves only the nepheline (I). The specimen is washed and dried, when felspar and dark-coloured minerals are readily detectable. To distinguish (I) from other minerals the specimen is dipped in 0·01% aq. aluminon slightly acidified with AcOH, when a red varnish is formed over the (I). The composition is determined by the point method at 1-mm. intervals. J. W. S.

Zeolites of the Crimea. M. N. Schkabara (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 659—661).—Descriptive. F. J. G.

Granites from the Vosges. (Mme.) E. Jérémine (Compt. rend., 1940, **210**, 571—573).—The deposits are described, and detailed chemical analyses are given for 14 specimens. A. J. E. W.

Weathering of igneous rocks. VI. Weathering-complex. M. Harada (J. Agric. Chem. Soc. Japan, 1940, **16**, 311—320; cf. A., 1938, I, 334).—The weathering complex in soils consists of three fractions, A_1 which is sol. in the dark in a solution containing 18·4 g. of $K_2C_2O_4$ and 3·2 g. of $H_2C_2O_4$

per l., A_2 which is insol. in this solution but is decomposed by hot conc. HCl, and B which is decomposed only by hot conc. H_2SO_4. The amounts of A_1 and A_2, and SiO_2, Al_2O_3, and Fe_2O_3 in A_1, A_2, and B in various kinds of soil from igneous rocks have been determined. When the humus in soils is oxidised by 3% aq. H_2O_2 in presence of $Fe(OH)_3$ part of the Al in A_1 becomes sol. in the $H_2C_2O_4$–oxalate solution. J. N. A.

Geochemistry of "vapps." A. M. KUZNETZOV and D. P. PROTSCHUCHAN (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 226—229).—The "vapps" (clays) and sandstones of Levshino, Perm, are described. The vapp crumbles in air to fine rubble and thin bent laminæ. Immersion in H_2O prevents this disintegration. The average chemical analysis recorded shows high CO_2, MgO, and CaO ($CaCO_3 + MgCO_3 =$ 17·89%). The vapps consist of a highly dispersed mass of argillaceous particles cemented with $CaCO_3$. L. S. T.

Mineralogical composition of clays and their physical and chemical properties. I. D. SEDLETZKI and S. JUSUPOVA (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 244—246).—Data recorded and discussed for certain Middle-Asiatic clays and loesses indicate that physical and chemical properties are related to composition of the constituent minerals. L. S. T.

Principles of classification of argillaceous minerals. I. D. SEDLETZKI (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 240—243).—The outlines of a classification based on the changes gel $\rightleftharpoons$ metastable minerals $\rightleftharpoons$ stable minerals are put forward and discussed. L. S. T.

Preparation of thin sections of clays. A. V. WEATHERHEAD (Min. Mag., 1940, **25**, 529—533).—A smooth surface, prepared by grinding on dry glass plates without the use of abrasives, is treated with amyl acetate and then with pyroxylin; after drying, the film is peeled off and mounted.

Blue rock-salt. H. PETTERSSON (Nature, 1940, **145**, 743—744; cf. A., 1940, I, 238).—1 p.p.m. of Au in rock-salt corresponds with a Au content in the original sea-H_2O of ~25 mg. per ton, which is $\gg$ the highest val. (0·04 mg. per ton) found experimentally. L. S. T.

Formula of jordanite. D. J. FISHER (Amer. Min., 1940, **25**, 297—298; cf. A., 1939, I, 226).—A discussion. The formula $Pb_{14}As_7S_{23}$ is preferred. L. S. T.

Optical properties and chemical composition of magnesian orthopyroxenes. H. H. HESS and A. H. PHILLIPS (Amer. Min., 1940, **25**, 271—285; cf. A., 1938, I, 588).—Twelve chemical analyses are recorded and discussed. Optical properties and chemical composition are correlated, and a revised nomenclature for members of the enstatite–orthoferrosilite series is suggested. L. S. T.

Gratonite—a new mineral from Cerro de Pasco, Peru. C. PALACHE and D. J. FISHER (Amer. Min., 1940, **25**, 255—265; cf. A., 1939, I, 284).—Gratonite has a_0 17·69, c_0 7·83 A., $a_0 : c_0 = 1 : 0·4426$, α 114° 05′; space-group C_{3v}^5 ($R3m$). A chemical analysis [F. A. GONYER] and a spectrographic analysis for trace elements are given. The formula is $Pb_{27}As_{12}S_{45}$ or $Pb_{27}As_{12}S_{42}$. Relationships to guitermanite, jordanite, and geocronite are discussed. L. S. T.

Geologic occurrence of gratonite at Cerro de Pasco, Peru. G. W. RUST (Amer. Min., 1940, **25**, 266—270). L. S. T.

Allanite from Barringer Hill, Llano Co., Texas. J. P. MARBLE (Amer. Min., 1940, **25**, 168—173).—A chemical analysis and optical properties are recorded. The ratios Pb/(U + 0·36Th) and He/(U + 0·27Th) are 0·428 and 8·76, respectively. The former val. indicates either a large accumulation of common Pb or extensive alteration. L. S. T.

Gold deposits of British Gold Coast (West Africa). F. E. KLINGER (Berg- u. Huttenm. Monatsh., 1940, **88**, 17—22).—The Au contents of various deposits are given. R. B. C.

Placer gold in Alaska. J. B. MERTIE, jun. (J. Washington Acad. Sci., 1940, **30**, 93—124).—The composition, distribution, and genesis of the Au found in Alaska placer deposits are discussed with special reference to the variations in the Ag : Au ratio. The theory that enrichment of the surface layers of the metal particles is due to slow dissolution of the Ag therefrom by surface waters is rejected. A. R. P.

Mizpah coal field, Custer County, Montana. F. S. PARKER and D. A. ANDREWS (U.S. Geol. Survey, 1939, Bull. 906-C, 8—133). L. S. T.

Geology and coal resources of the Minot region, N. Dakota. D. A. ANDREWS (U.S. Geol. Survey, 1939, Bull. 906-B, 43—84). L. S. T.

Microscopical investigation of podzol from the town Kirovsk. P. N. TSCHIRVINSKI (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 156—158).—The material examined consists mainly of quartz grains, with felspar in secondary quantities. A detailed examination of the constituents suggests that the podzol is made up chiefly of materials of gneisses, granites, amphibolites, and to a smaller extent kyanite shales and Khibin alkaline rocks. L. J. J.

Calcium montmorillonite in saline soils. I. SEDLETZKI (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 154—155).—Thermal and X-ray examination of Na saline soils from the left bank of the Volga and the Chernigov province show the presence of montmorillonite (I) in the $<0·2\text{-}\mu$. fraction in all cases. Mg is combined undisplaceably with (I) and beidellite, and Ca undisplaceably with (I). It is suggested that Ca can displace Mg isomorphically, giving eventually $(Al_2Ca_3)(OH)_3Si,CaSi_4O_{10}$. With decreasing alkalinity during the leaching of soils, Ca-(I) is converted into Mg-(I), in accordance with the lower cryst. lattice energy for Ca. L. J. J.

Alteration of miocene basalts in the Cantal, and nature of derived soils. H. ERHART (Compt. rend., 1940, **210**, 537—539).—The changes are discussed with reference to detailed chemical analyses [RAOULT] and soil p_H data. A. J. E. W.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

SEPTEMBER, 1940.

Determination of the Rydberg constants, *e/m*, and the fine structures of H_α and D_α by means of a reflexion echelon. J. W. DRINKWATER, (SIR) O. RICHARDSON, and W. E. WILLIAMS (Proc. Roy. Soc., 1940, **A**, **175**, 345).—A correction to numerical data (cf. A., 1940, I, 191). G. D. P.

Spectra of highly ionised argon. W. L. PARKER and L. W. PHILLIPS (Physical Rev., 1940, [ii], **58**, 93—94; cf. Boyce, A., 1935, 1291).—By feeding the gas from a bronze capillary into a small hole drilled through the base of the Al or C lower electrode of a vac.-spark source it was possible to excite higher-order spectra. Data and classifications for 25 lines in the range λλ 596—191 of A IV, V, VI, VII, VIII are tabulated. N. M. B.

Nuclear electric quadrupole moment for ^{123}Sb. D. H. TOMBOULIAN and R. F. BACHER (Physical Rev., 1940, [ii], **58**, 52—54).—Measurements of the hyperfine structure of λ 5895 of Sb II show deviations from the interval rule for isotope 123. The intervals of the $^3D_1$ level of ^{121}Sb are 0·6801 and 0·4832 cm.$^{-1}$, and those in ^{123}Sb are 0·4814 and 0·3603 cm.$^{-1}$ (all $\pm$0·001). The observed ratio of the two separations gives 1·407 and 1·336 for the light and heavy isotope, respectively, whereas the corresponding ratios from the interval rule are 1·400 and 1·286. The deviation of the latter is unaccountable on perturbing effects of neighbouring levels, and thus denotes an electric quadrupole moment of the ^{123}Sb nucleus. N. M. B.

Hyperfine structure in the spectrum of bromine [Br I]. S. TOLANSKY and S. A. TRIVEDI (Proc. Roy. Soc., 1940, **A**, 175, 366—382).—65 lines of the Br I spectrum in the range 8650—4350 A. have been investigated for hyperfine structure and analysed and some errors in the multiplet analysis have been corr. The nuclear mechanical and magnetic moments of both isotopes are the same; no isotope displacement has been observed. G. D. P.

Zeeman effect of gold. H. N. MAXWELL and J. B. GREEN (Physical Rev., 1938, [ii], **53**, 330).—Several of the classifications of Au I by Symons and Daley (A., 1929, 1207) in the region 5000—6000 A. have been confirmed by measurements of the Zeeman effect, and the *g* vals. determined. Well-defined multiplets appear in the Au II lines in the region 4760—5726 A., and indicate transitions between a new configuration $5d^86s6p$ and $5d^86s7s$ or $5d^96d$. L. S. T.

Zeeman effect of selenium II. J. B. GREEN and R. A. LORING (Physical Rev., 1938, [ii], **53**, 330).—The Zeeman effect in several of the strongest lines of Se II has been investigated in fields of ~37,500 gauss. L. S. T.

Stark effect of anomalous lines of mercury spectrum. Y. ISHIDA and S. HIYAMA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 227—231; cf., A., 1940, I, 50).—The λλ and Stark effects of anomalous lines in the Hg spectrum, five newly observed, are recorded. Lines are classified in accordance with the term configurations suggested by Murakawa (A., 1933, 656). O. D. S.

Doppler effect observed in Lo Surdo discharge tube. H. KUBOTA (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 531—536).—Doppler broadening of lines in the spectra of Ne^+, C^+, and N^+ in the Lo Surdo discharge has been measured and is attributed to acceleration of ions in the electric field in front of the cathode. O. D. S.

Doppler effect in resonance lines. L. G. HENYEY (Proc. Nat. Acad. Sci., 1940, **26**, 50—54).—Mathematical. A consideration of the distribution of the scattered light over the various parts of a broadened spectral line. N. M. B.

Polarisation of light emitted by electrically exploded wires. W. M. COHN (Physical Rev., 1940, [ii], **58**, 50—51).—A photographic investigation of exploded Cu and constantan wires showed no polarisation, within the limits of accuracy. It is concluded that scattered and reflected light do not contribute to the emission; thus only temp. radiation and continuous electron radiation remain as factors causing emission of the continuous spectrum. N. M. B.

Synthetic spectra for supernovæ. C. PAYNE-GAPOSCHKIN and F. L. WHIPPLE (Proc. Nat. Acad. Sci., 1940, **26**, 264—272).—An attempt has been made to reconstruct supernova spectra by summation of the bright-line spectra of the astrophysically commoner elements to produce combined spectra of successively increasing excitation. The blue region shows a red shift with increasing excitation, resembling that found with time in the supernova spectra. L. J. J.

Position of the centre of the Compton modified band. G. E. M. JAUNCEY (Physical Rev., 1938, [ii], **53**, 332).—An expression for the profile of the Compton band is given. L. S. T.

Determination of widths of energy states: argon *K* absorption limit. F. K. RICHTMYER and L. G. PARRATT (Physical Rev., 1938, [ii], **53**, 678—679).—The width of the *K* state of A has been measured. L. S. T.

Experimental and theoretical photo-electric spectral sensitivity of strontium and magnesium. R. J. CASHMAN and E. BASSOE (Physical Rev., 1938, [ii], **53**, 919).—Photo-electric yields have been

obtained as a function of frequency for condensed layers of Sr and Mg formed by fractional distillation in a gettered vac. The range of λ for Sr was from the threshold (~4500 A.) to 3000 A. and for Mg, from 3400 to 2000 A. Unlike the alkali metals, the response from both metals is characterised by the absence of a selective max. for the range investigated. Comparison of theoretical and experimental data shows that the selective max. with the alkali metals is to be expected. L. S. T.

Time-lag analysis of the Townsend discharge in argon with activated cæsium electrodes. R. W. ENGSTROM and W. S. HUXFORD (Physical Rev., 1940, [ii], **58**, 67—77; cf. A., 1939, I, 291).—A study of the time lag in a photo-electric, gas-amplified discharge for parallel electrodes as a function of gas pressure, plate separation, and amplification shows that diffusion of metastable A atoms is the source of the lag and that these atoms striking the activated Cs cathode are highly efficient in liberating secondary electrons. The Townsend ionisation coeffs., α and γ, were determined for a range of vals. of E/p_0. Analysis of the time-lag function has allowed separation of the no. of secondary electrons released at the cathode into those due to positive ions and those produced by metastable A atoms. A factor representing the fraction of electron energy gained in the field used to excite atoms to the metastable level is determined as a function of E/p_0. The coeff. of diffusion of metastable A atoms in A is computed and shown to be that expected for a metastable atom having a diameter effectively 1·74 times that of the normal atom. N. M. B.

Nature of ions emitted by heated filaments and salts. B. TOUBES and G. K. ROLLEFSON (J. Chem. Physics, 1940, **8**, 495—496).—W, Ta, and Mo filaments emit positive ions when heated to temp. slightly < the m.p.; $Na^{\cdot}$ and $K^{\cdot}$ ions are also emitted by each. Alkali halides were heated on a Pt spiral to 800—1000° and $Na^{\cdot}$, $K^{\cdot}$, and $Rb^{\cdot}$ ions were emitted, but not $Mg^{\cdot\cdot}$, $Ca^{\cdot\cdot}$, $Sr^{\cdot\cdot}$, $Ba^{\cdot\cdot}$, or $Zn^{\cdot\cdot}$. No negative ions were obtained. W. R. A.

Multiple scattering of electrons. II. S. GOUDSMIT and J. L. SAUNDERSON (Physical Rev., 1940, [ii], **58**, 36—42).—Mathematical. Results previously reported (cf. A., 1940, I, 89) are brought into a form more easily comparable with experiment and evaluations are tabulated for a large no. of cases. N. M. B.

Electron path lengths in multiple scattering. M. E. ROSE (Physical Rev., 1940, [ii], **58**, 90; cf. Goudsmit, A., 1940, I, 185).—Mathematical. A more exact derivation. N. M. B.

Resolving power of the magnetic electron lens used as a β-ray spectrometer. V. E. COSSLETT (Proc. Physical Soc., 1940, **52**, 511—517).—Expressions for the resolving power are obtained and compared with the focussed spread of experimental electron velocities. The influence of spherical aberration is small for the apertures employed. Results indicate how high resolving power may be attained. N. M. B.

Apparent discrepancy among the experimental measurements of the atomic constants. R. A. BETH (Physical Rev., 1938, [ii], **53**, 681).—Mathematical. L. S. T.

Electronic charge. T. H. LABY and V. D. HOPPER (Nature, 1940, **145**, 932—933).—The val. of e obtained by a new oil-drop method (A., 1939, I, 237) is $(4{\cdot}8020\pm0{\cdot}0013)\times10^{-10}$ e.s.u., assuming η_{23} for air to be 1830×10^{-7} c.g.s. unit. The probable error is ~ one third of that obtained by Millikan, whose result becomes $(4{\cdot}7992\pm0{\cdot}0037)\times10^{-10}$ e.s.u. with the above val. of η_{23}. The recalc. mean of X-ray determinations of e is $(4{\cdot}8044\pm0{\cdot}0007)\times10^{-10}$ e.s.u. The uncertainty in the val. of η_{23} contributes the major uncertainty in the oil-drop method, and gives an error > the difference between the oil-drop and X-ray vals. of e. L. S. T.

Cross-section of atomic oxygen for elastic collision with electrons, and region *F* absorption. S. K. MITRA, B. B. RAY, and S. P. GHOSH (Nature, 1940, **145**, 1017).—Cross-sections computed from quantum mechanics show that at. O exhibits the Ramsauer effect. The val. calc. for the collisional frequency in region F, where at. O predominates, agrees with that obtained from radio measurements. The val. calc. by taking the gas-kinetic cross-section is too small. L. S. T.

Orientation of nuclear spins in metals. H. FRÖHLICH and F. R. N. NABARRO (Proc. Roy. Soc., 1940, **A**, **175**, 382—391).—A mathematical investigation shows that owing to interaction between nuclear spins and conduction electrons, the nuclei of most univalent metals should become ferromagnetic at a temp. of about 10^{-6} degree. Temp. of this order should therefore be attainable by application of the magnetic cooling method. G. D. P.

Scattering of slow positive ions at very small angles. A. G. EMSLIE (Physical Rev., 1938, [ii], **53**, 680).—150—300-v. Li ions scattered by Na vapour or by polished Ni show an unexpectedly uniform scattering up to angles of ~0·5°; at larger angles, the intensity falls off abruptly. L. S. T.

Slowing up of heavy ions in matter: application to uranium fission. P. HAVAS (J. Phys. Radium, 1940, [viii], **1**, 146—154).—Theoretical. Radiative capture of K electrons is stated to be sufficiently probable for the products of U fission to be observable. Slowing up of heavy ions is principally dependent on the non-radiative capture processes. Formulæ are derived which explain experimental data. W. R. A.

Hoffmann collisions and the multiplication theory. E. G. STEINKE and H. SCHMID (Naturwiss., 1940, **28**, 93—94).—According to the cascade theory the max. of the collision frequency in the collision extinction curve should be continuously displaced. Experiments are described by which the max. is found to be const. for collisions involving $0{\cdot}1$—$3{\cdot}4\times10^6$ ion pairs. A. J. M.

Magnetic moments of neon and argon. J. M. B. KELLOGG and N. F. RAMSEY (Physical Rev., 1938, [ii], **53**, 331).—Experiments showing that if Ne and A

have magnetic moments they are <0·05 nuclear magneton are reported. L. S. T.

At. wt. of potassium. G. P. Baxter and C. D. Harrington (J. Amer. Chem. Soc., 1940, **62**, 1836—1837).—From analysis of KCl the at. wt. of K is 39·098. F. J. G.

Specific gravity of iodine pentoxide and at. wt. of iodine. G. P. Baxter and M. W. Kelley (J. Amer. Chem. Soc., 1940, **62**, 1824—1825).—Polemical against Moles (A., 1937, I, 57). ρ for I_2O_5 has been redetermined by displacement of various liquids, giving vals. ranging from 4·905 to 4·980, and of air, giving 4·980. With this val. no correction of earlier determinations of the at. wt. of I is needed. F. J. G.

At. wt. of iodine. Ratio of silver iodide to silver chloride. G. P. Baxter and A. C. Titus (J. Amer. Chem. Soc., 1940, **42**, 1826—1828).—By direct conversion of AgI into AgCl, the at. wt. of I is found to be 126·915, which is slightly < that found by Hönigschmid (A., 1932, 1073). F. J. G.

At. wt. of iodine. I. Ratio of silver to silver iodide. II. Ratio of silver iodide to silver chloride. G. P. Baxter and O. W. Lundstedt (J. Amer. Chem. Soc., 1940, **62**, 1829—1834).—From the ratios Ag : I and AgI : AgCl the at. wt. of I is 126·915 (see preceding abstract), which is between Hönigschmid's val. and the best mass-spectrographic val. F. J. G.

At. wt. of cæsium. G. P. Baxter and C. D. Harrington (J. Amer. Chem. Soc., 1940, **62**, 1834—1836).—From analysis of CsCl the at. wt. of Cs is 132·913 (Ag = 107·880, Cl = 35·457), and its packing fraction is $-3{\cdot}8\times10^{-4}$. F. J. G.

Isotopic weight of helium by direct comparison with oxygen. K. T. Bainbridge (Physical Rev., 1938, [ii], **53**, 922).—The separation of the doublet He_2^+–O^{++} is 0·00772±0·00012 mass unit, corresponding with a mass of 4·00386±0·00006 for He. L. S. T.

Isotopic weight of ^{12}C. J. Mattauch (Physical Rev., 1940, [ii], **57**, 1155—1159).—In view of a discrepancy outside probable error in the mass data of ^1H, ^2D, and ^{12}C and the dependence of isotopic masses determined by the doublet method on the masses of these substandards, checks on available measurements and Aston's objections and criticisms are discussed in detail. The most reliable mass vals. are considered to be $^1H = 1{\cdot}008130\pm0{\cdot}0000033$; $^2D = 2{\cdot}014722\pm0{\cdot}0000064$; $^{12}C = 12{\cdot}003861\pm0{\cdot}000024$; $^{14}N = 14{\cdot}00753\pm0{\cdot}000032$. N. M. B.

Masses of stable nuclei from ^{20}Ne to ^{57}Fe. E. Pollard (Physical Rev., 1940, [ii], **57**, 1186—1187).—From observation of proton groups in (dp) and (αp) reactions and from β-ray max. energies, isotopic masses are tabulated. "Mass deviation" (from a whole no.) is plotted against mass no. Irregularities above ^{40}Ca and a strong fluctuation between ^{53}Cr and ^{55}Mn are discussed in terms of filling of neutron and proton shells. N. M. B.

Periodic properties of isotopes. A. E. Haas (Proc. Nat. Acad. Sci., 1940, **26**, 305—312).—A classification of known isotopes according to the difference between nos. of neutrons and protons reveals regularities in the no. of isotopes in each group, relative abundance, and stability after addition of protons or neutrons. L. J. J.

Segregation of polonium in bismuth crystals. A. B. Focke (Physical Rev., 1938, [ii], **53**, 324—325).—Earlier work (A., 1934, 1284) is confirmed. The Po is segregated into small regions separated by distances of 0·55±0·01 μ. and 0·86±0·03 μ. in directions parallel to the (111) and $11\bar{1}$) axes, respectively. Where twinning due to cold-working occurs the spacing along the original (111) axis changes to that expected along ($11\bar{1}$), the distribution of impurity following the crystallographic change. This indicates either a large-scale migration of Po at relatively low temp., or that the twinning process is not at. in nature. L. S. T.

Radioactivity of air, water, cave, and soil gases. O. G. Fryer (Physical Rev., 1938, [ii], **53**, 325).—An electroscope suitable for field work has been constructed. Rainfall affects the Rn content in some springs more than in others. Radioactivity is not $\propto$ to rainfall, but a continued dry spell is marked by a decrease in activity of most springs. There is no correlation between atm. pressure and [Rn] of spring H_2O. The Rn content of soil gases increases with depth; in Indiana it is $\gg$ that in other countries, but the activity of the air is less. L. S. T.

Capture cross-section for thermal neutrons. A. H. Spees, W. F. Colby, and S. Goudsmit (Physical Rev., 1938, [ii], **53**, 326).—Vals. obtained for H and NaCl are $0{\cdot}26\pm0{\cdot}02\times10^{-24}$ and $36\pm4\times10^{-24}$ cm.², respectively, based on Cd 2600×10^{-24} cm.² L. S. T.

Neutron yields from deuteron reactions at high energy. L. W. Alvarez (Physical Rev., 1938, [ii], **53**, 326).—The relative yields from 15 elements bombarded with 7·6-Mev. deuterons have been measured. Various comparisons indicate that the no. of neutrons from C is > that accounted for by the reaction leading to ^{13}N; the reaction $^{12}C + d \rightarrow {}^{12}C + n + p$ is probably responsible for the excess. L. S. T.

Collimation of slow neutrons. J. G. Hoffman and M. S. Livingston (Physical Rev., 1938, [ii], **53**, 676).—A collimated beam of slow neutrons with an angular spread of 9° is produced and analysed by means of absorbers of Cd and CB_4, and detected in a BF_3 gas chamber actuating a linear amplifier and counter. L. S. T.

Nuclear fission. K. K. Darrow (Science, 1940, **91**, 514—516).—An address. L. S. T.

Mean life of ^{87}Rb. E. J. Konopinski and H. A. Bethe (Physical Rev., 1938, [ii], **53**, 679). L. S. T.

Scattering of neutrons by gases. H. Carroll, P. N. Powers, H. G. Beyer, and J. R. Dunning (Physical Rev., 1938, [ii], **53**, 680).—Measurements for a large no. of gases in a high-pressure gas scattering cell show that the proton in H_2 gas has a cross-section of $\sim35\times10^{-24}$ sq. cm. compared with $45{\cdot}0\times10^{-24}$ sq. cm. for the proton in CH_4. L. S. T.

Multiple ejection of neutrons from excited nuclei. R. L. THORNTON and J. M. CORK (Physical Rev., 1938, [ii], **53**, 922).—The ratio of the 4-hr. (n, $3n$) to the 53-hr. (n, $2n$) activities in Sc activated by 10—20-Me.v. neutrons is practically const., indicating that the two periods are due to isomerides of ^{44}Sc. Relative activation functions for the (n, $2n$) reaction for O_2, N_2, C, Cu, and Ag are of different form; anomalous behaviour for O_2 and Cu is indicated.
L. S. T.

Radioactivity of ^{10}Be. E. BRETSCHER (Nature, 1940, **146**, 94—95).—The radioactivity of ^{10}Be has been further investigated by irradiating H_3BO_3 with neutrons from Li + 900-kv. deuterons, and examining the Be after chemical separation. The val. obtained for the upper limit of the cross-section of this reaction, formerly assumed to be ^{9}Be (^{2}H,^{1}H)^{10}Be, is so small that either the reaction is very improbable, or the activity observed previously (cf. A., 1940, I, 140) is not ^{10}Be. L. S. T.

Resonance levels of rhodium and indium. J. HORNBOSTEL, H. H. GOLDSMITH, and J. H. MANLEY (Physical Rev., 1940, [ii], **58**, 18—23; cf. A., 1940, I, 172, 173).—Self-absorption curves and mutual-absorption curves of the In and Rh neutron-capture levels were measured and vals. for the absorption coeffs. for self-indication, resonance cross-sections, natural widths, neutron width, and spacing of the two levels are deduced. N. M. B.

Radiative K capture. P. MORRISON and L. I. SCHIFF (Physical Rev., 1940, [ii], **58**, 24—26; cf. Bloch, A., 1936, 1172).—Mathematical. Accompanying K capture, as in β-activity, there is a weak continuous high-energy γ-ray spectrum. The major contribution to the effect is from magnetic radiative capture of a K electron. For an allowed transition, using Fermi or Gamow–Teller coupling, the no. of γ-quanta per K electron captured is $(\alpha/12\pi)(W/mc^2)^2$, where W is the available energy. For other couplings and forbidden transitions the effect is of the same order of magnitude. N. M. B.

Scattering of thermal neutrons by deuterons. L. MOTZ and J. SCHWINGER (Physical Rev., 1940, [ii], **58**, 26—36; cf. Schiff, A., 1937, I, 489).—Mathematical. Neglecting polarisation but taking into account exchange effects, the cross-section is calc. The vals., using two sets of g, are $4{\cdot}57 \times 10^{-24}$ and $6{\cdot}91 \times 10^{-24}$ sq. cm. The experimental val. is at least 20% < the first of these vals. N. M. B.

Evidence against the existence of an excited state of ^{3}He. R. D. PARK and J. C. MOUZON (Physical Rev., 1940, [ii], **58**, 43—46; cf. Hudspeth, A., 1939, I, 293; Schiff, A., 1938, I, 429).—The distribution of energies of neutrons from the d-d reaction was determined from cloud-chamber measurements of 126 tracks of recoil protons produced. No evidence for a low-energy group of neutrons, and consequently an excited state of ^{3}He, was obtained.
N. M. B.

Comparative efficiencies of radioactive neutron sources. E. J. MURPHY, W. C. BRIGHT, M. D. WHITAKER, S. A. KORFF, and E. T. CLARKE (Physical Rev., 1940, [ii], **58**, 88).—Relative neutron yields per mg. equiv. from three Ra–Be sources of ~200 mg. γ-ray strength were 1, 0·97, and 0·85, and from one of 9·87 mg. γ-ray strength was 0·88. Yields from Rn–Be sources of 60 and 30 mc. strength were 0·55 and 0·76, respectively. Results show that yields are not, as usually supposed, ∝ γ-ray activity.
N. M. B.

Scattering cross-section of protons for 900-ke.v. neutrons. W. E. GOOD and G. S. GOLDHABER (Physical Rev., 1940, [ii], **58**, 89).—In the absence of data for 0·4—2 Me.v., the absorption of RdTh + Be photo-neutrons in paraffin and C was investigated. Results give a scattering cross-section for C of $2{\cdot}63 \pm 0{\cdot}25 \times 10^{-24}$ sq. cm., an "ideal" mean free path of 2·28 g. per sq. cm. in paraffin, and a proton–neutron cross-section of $3{\cdot}70 \pm 0{\cdot}35 \times 10^{-24}$ sq. cm. in fair agreement with Wigner's zero-range formula.
N. M. B.

Spontaneous fission of uranium. FLEROV and PETRJAK (Physical Rev., 1940, [ii], **58**, 89).—Ionisation chamber pulses ascribed to spontaneous fission of U were observed. Pulse-energy and absorption properties coincide with fission products of U bombarded by neutrons. N. M. B.

Scattering of D–D neutrons. W. D. ALLEN and C. HURST (Proc. Physical Soc., 1940, **52**, 501—510; cf. A., 1939, I, 591).—The scattering cross-sections for the combined processes of absorption and inelastic scattering of D–D neutrons were measured in 24 elements. The neutrons, of energy 3·25 Me.v., were detected by P in which the 170-min. ^{31}Si period was induced. Results confirm Kikuchi (cf. *ibid.*, 171); the cross-section does not increase monotonically with at. no., but rather shows a periodic dependence on at. no. Elastic scattering of D–D neutrons was not observed. N. M. B.

Nuclear radiations from antimony and arsenic. A. C. G. MITCHELL, L. M. LANGER, and P. W. McDANIEL (Physical Rev., 1940, [ii], **57**, 1107—1117; cf. A., 1940, I, 4).—Measurements for ^{76}As, ^{122}Sb, and ^{124}Sb on γ-ray energies by coincidence absorption of their Compton recoils and on β-ray end-points by absorption in Al indicate, in As, three groups of β-rays (end-point of highest-energy group $3{\cdot}24 \pm 0{\cdot}20$ Me.v.) all going to excited states of ^{76}Se; the energy of the hardest γ-ray was $2{\cdot}05 \pm 0{\cdot}05$ Me.v. Separation of the effects due to ^{122}Sb (2·5 days) and ^{124}Sb (60 days) gave a β-ray spectrum of ^{124}Sb consisting of only one group (end-point $1{\cdot}53 \pm 0{\cdot}05$ Me.v.) going to an excited state of ^{124}Te; the highest γ-ray energy was $1{\cdot}82 \pm 0{\cdot}05$ Me.v.; evidence suggests the alternative process of K-electron capture with a transition to ^{124}Sn. The β-ray spectrum of ^{122}Sb consists of two groups (end-points $1{\cdot}76 \pm 0{\cdot}10$ and 0·81 Me.v.), one of which goes to the ground state of ^{122}Te; the energy of the single γ-ray is 0·96 Me.v. A self-consistent energy-level scheme for ^{122}Sb is given. N. M. B.

Anomalous scattering of neutrons by helium. T. W. BONNER and E. HUDSPETH (Physical Rev., 1940, [ii], **57**, 1187—1188; cf. A., 1940, I, 307).—In view of the anomalously high scattering cross-section of 1-Me.v. neutrons in He, the ratio of observed ionisation currents in He and H is plotted as a function of neutron energy for 0—1-Me.v. neutrons,

for conditions under which the ratio is a measure of that of scattering cross-section in He and H. The curve rises smoothly to a max. at $\sim$1·1 Me.v.

N. M. B.

Experiments with a velocity-spectrometer for slow neutrons. G. E. F. FERTEL, D. F. GIBBS, P. B. MOON, G. P. THOMSON, and C. E. WYNN-WILLIAMS (Proc. Roy. Soc., 1940, **A**, **175**, 316—331).—The instrument measures the time of transit of individual neutrons from an intermittent source to a distant ionisation chamber. The velocity distribution of slow neutrons from paraffin wax at room temp. has been measured, and the absorption coeff. of B and Cd investigated. G. D. P.

Excited states of stable nuclei. C. F. POWELL, A. N. MAY, J. CHADWICK, and T. G. PICKAVANCE (Nature, 1940, **145**, 893—894).—The scattering of fast (4-Me.v.) protons by light elements has been investigated. With O_2, the distribution curve shows a single peak corresponding with protons scattered elastically through 90°. With Ne, there is an elastically-scattered group, and a peak at lower energy attributed to inelastic scattering from ^{20}Ne. The inelastically-scattered protons appear to have been "evaporated" from the compound nucleus formed in a close collision of an incident proton and a ^{20}Ne nucleus. With Cl_2 and A, the ratio of inelastically- to elastically-scattered particles is $\ll$ with Ne, corresponding with the decreasing probability of the protons entering the nucleus with increasing nuclear charge. The method affords a powerful means of investigating the excited states of at. nuclei. L. S. T.

Search for short-lived radioelements. L. W. ALVAREZ (Physical Rev., 1938, [ii], **53**, 215).—No short-life ($>$0·3 sec.) products could be detected from the neutron bombardment of Pt, Au, Hg, Tl, and Pb. L. S. T.

Radioactivities induced by high-energy protons. L. A. DUBRIDGE, S. W. BARNES, E. O. WIIG, J. H. BUCK, and C. V. STRAIN (Physical Rev., 1938, [ii], **53**, 326; cf. A., 1938, I, 291).—e^+- and e^--emitting isotopes that have been found are listed.

L. S. T.

Radioactive isotopes of zinc. R. L. THORNTON (Physical Rev., 1938, [ii], **53**, 326—327).—These isotopes have been investigated by bombarding Zn, Cu, and Ga with high-energy deuterons and slow and fast Li + D neutrons. A provisional assignment of periods is ^{63}Zn, 35 min.; ^{65}Zn, 1 hr.; and ^{69}Zn, 14 hr. The 65-min. period radioactivity produced in Zn by deuteron bombardment of Cu suggests either a (D, γ) reaction from ^{63}Cu or a $(D, 2n)$ reaction from ^{65}Cu. L. S. T.

Induced radioactivity in tellurium. G. F. TAPE and J. M. CORK (Physical Rev., 1938, [ii], **53**, 676—677).—Chemical separation of the Te after bombardment with 6-Me.v. deuterons yields radioactive Te isotopes of half-life 66 min., 10 hr., and 8 days, and certain active I isotopes by proton capture. Bombardment with Li neutrons gives in the Te activities of 66 min., 10 hr., and 31 days half-life. The Sb ppt. from the Te bombarded with deuterons gives a 60-day period. I bombarded with fast neutrons gives the 26-min. period due to ^{128}I and a 13-day activity attributable to ^{126}I. As all these radioactive elements emit negative electrons, the 8-day, 66-min., and 10-hr. activities are assigned to ^{131}Te, ^{127}Te and ^{129}Te, respectively. The 31-day activity, produced only by fast neutrons, may be due to ^{121}Te. The active ^{131}Te and ^{129}Te emit electrons and become ^{131}I and ^{129}I, which in turn emit β-particles to form stable ^{131}Xe and ^{129}Xe. L. S. T.

β-Radiation from activated isotopes of arsenic. B. R. CURTIS and J. M. CORK (Physical Rev., 1938, [ii], **53**, 681).—Measurements indicate an upper limit of 0·65 Me.v. for the positron spectrum of the 13·5-day activity of ^{74}As and $\sim$2·3 Me.v. for the 26-hr. negative activity of ^{76}As. L. S. T.

Induced radioactivities. J. J. LIVINGOOD and G. T. SEABORG (Rev. Mod. Physics, 1940, **12**, 30—46).—A tabulation of all known radioactive isotopes (to the end of 1939) giving degree of certainty of assignment, type of radiation, half-life, energy of radiation, reaction of formations, and references. A list of mass nos. and relative abundances of all known stable isotopes is included. N. M. B.

Collisions of α-particles with carbon nuclei. G. A. WRENSHALL (Physical Rev., 1940, [ii], **57**, 1095—1100).—With a cloud chamber filled in one series with MeCl and He, and in another with C_2H_2 and He, $>$750,000 Th-C + C' α-particle tracks were photographed. For each series a range–velocity curve for C was constructed by plotting the measured ranges, reduced to standard air vals., against the calc. velocities for 55 selected α-particle–C collisions. These curves, used as a test, show the partial validity of the method of reducing the ranges of heavy recoil nuclei in any gas to standard air vals. N. M. B.

Protons from the transmutation of boron by deuterons. E. POLLARD, W. L. DAVIDSON, jun., and H. L. SCHULTZ (Physical Rev., 1940, [ii], **57**, 1117—1120).—The technique of studying proton groups produced by bombarding elements with deuterons from a cyclotron is described. Applied to the bombardment of B by 3·1-Me.v. deuterons, three groups agreeing with Cockeroft and Lewis are found and a new very prominent fourth group of Q val. 2·39 Me.v. is ascribed to a third excited state of ^{11}B.

N. M. B.

Radiations from radioactive ^{116}In. B. R. CURTIS and J. R. RICHARDSON (Physical Rev., 1940, [ii], **57**, 1121—1124; cf. Lawson, A., 1937, I, 594).—Investigations of the γ-radiation from ^{116}In (54 min.) by means of Compton recoil electrons from a C radiator and photo-electrons from Pb with a large H_2-filled cloud chamber show γ-ray lines of 1·02, 1·40, and 1·85$\pm$0·05 Me.v. energy and relative intensities 1, 1, and 0·25, respectively. The momentum distribution of the photo-electrons from Pb indicates low-energy γ-ray lines of energies 0·17, 0·36, and 0·57$\pm$0·03 Me.v., each of relative intensity $\sim$1/7 that of the 1·02 line. The upper energy limit of the β-ray spectrum was found to be 0·84$\pm$0·01 Me.v. Measurement of the β-ray/γ-ray ratio shows that $>$1 quantum

per electron is emitted. A level scheme in agreement with data is proposed. N. M. B.

Artificial radioactivity induced in zirconium and molybdenum. R. SAGANE, S. KOJIMA, G. MIYAMOTO, and M. IKAWA (Physical Rev., 1940, [ii], **57**, 1179—1180; cf. A., 1939, I, 54).—Detailed tabulations of the complex available data. N. M. B.

Induced β-activity of uranium by fast neutrons. Y. NISHINA, T. YASAKI, H. EZOE, K. KIMURA, and M. IKAWA (Physical Rev., 1940, [ii], **57**, 1182).—U_3O_8 bombarded by fast neutrons for >50 hr. and purified from possible elements produced by fission and from its own disintegration products showed a 6·5-day period (cf. A., 1940, I, 592) probably due to ^{237}U produced from ^{238}U by loss of a neutron. From the absence, after 7 days, of β- or α-activities it is concluded that the 6·5-day U decays into a very long-lived 93 element. N. M. B.

Radioactive element 93. E. MCMILLAN and P. H. ABELSON (Physical Rev., 1940, [ii], **57**, 1185—1186; cf. A., 1939, I, 235; Segrè, *ibid.*, 397).—In view of difficulties arising from the identification as a rare earth of a non-recoiling 2·3-day period in U activated by neutrons, a detailed investigation of chemical properties is reported. Results indicate that the oxidised and reduced states are similar to those of U (U^{++++} and UO_2^{++} or $U_2O_7^{--}$) but the oxidation potential is different. It is suggested that there may be a second "rare earth" group starting with U. The 2·3-day product ($^{239}93$) arises from U (23 min.) and emits continuous negative β-particles with an upper limit of 0·47 Me.v., and a weak complex spectrum of low-energy γ-rays (<0·3 Me.v.) and probably *X*-rays. If its disintegration product $^{239}94$ emits α-particles or undergoes spontaneous fission the half-life must be $\sim 10^6$ years. N. M. B.

Neutron-induced radioactivity of tungsten. O. MINAKAWA (Physical Rev., 1940, [ii], **57**, 1189).—On irradiating pure W powder intermittently for ~100 hr. with neutrons from a cyclotron under various conditions, the previously-known 24·0±0·1-hr. period and a new 77±3-day period were found. The former is produced almost entirely by slow neutrons and the latter by slow and fast neutrons; they are ascribed to ^{187}W and ^{185}W, respectively. The upper energy limits of the β-rays were 1·1±0·1 and ~0·4—0·5 Me.v., respectively, both periods being accompanied by a considerable amount of γ-rays. N. M. B.

Radioactive isotopes of strontium, yttrium, and zirconium. L. A. DUBRIDGE and J. MARSHALL (Physical Rev., 1940, [ii], **58**, 7—11; cf. A., 1939, I, 590).—The following activities, periods, and emission products formed by bombardment of Rb, Sr, and Y by protons, deuterons, and neutrons are reported: $^{87*}Sr$ (2·75 hr., e^-, γ); ^{85}Sr (70 min., e^-, γ); ^{85}Sr (66 days, *K*, γ); ^{87}Y (80 hr., *K*); ^{87}Y (14 hr., e^-, γ); ^{86}Y (105 days, *K*, γ); ^{89}Zr (4·5 min., γ); ^{89}Zr (78 hr., β^+), where *K* = *K* electron capture and e^- = conversion electron. The electron spectrum of $^{87*}Sr$ (2·75 hr.) shows a single line at 360 ke.v., and this period grows from ^{87}Y (80 hr.) but not from ^{87}Y (14 hr.). N. M. B.

Transmutation of the separated isotopes of neon by deuterons. E. POLLARD and W. W. WATSON (Physical Rev., 1940, [ii], **58**, 12—18; cf. A., 1940, I, 332).—Under bombardment by 2·6-Me.v. deuterons, Ne emits a large yield of protons falling into groups of energy-change vals. 1·02, 2·15, 3·13, and 4.88 Me.v., and these, by bombarding Ne enriched in ^{22}Ne and ^{20}Ne prepared by thermal diffusion, were found to correspond with excited states of ^{21}Ne. The reaction is ^{20}Ne (*d*, *p*) ^{21}Ne. The max. energy of the protons leads to the val. 21·00017 for the mass of ^{21}Ne. The bombarded gas was radioactive and the presence of ^{23}Ne due to ^{22}Ne (*d*, *p*) ^{23}Ne and ^{21}Na due to ^{20}Ne (*d*, *n*) ^{21}Na was established. The β-rays from ^{23}Ne consist of a single group of max. energy 4·1 Me.v., leading to a probable val. 23·0010 for the mass of ^{23}Ne. N. M. B.

Induced radioactivity of krypton. E. P. CLANCY (Physical Rev., 1940, [ii], **58**, 88).—Irradiation of Kr with 11-Me.v. deuterons gave strong activities of periods 102 min. and 4·0 hr., and a weak activity of ~35 hr. Kr separated from Se after irradiation with 22-Me.v. α-particles gave a strong 114-min. activity assigned to $^{83*}Kr$ (cf. Langsdorf, A., 1940, I, 141), and a weak activity of ~33 hr. The 102-min. period is probably due to $^{83*}Kr$ formed by a (*d*, *p*) or (*d*, *d*) reaction; the 4-hr. period is due to $^{87*}Kr$. The 35-hr. period is probably due to $^{79*}Kr$ or $^{81*}Kr$. N. M. B.

Radio-isotopes of Ba and Cs. D. C. KALBFELL and R. A. COOLEY (Physical Rev., 1940, [ii], **58**, 91—92).—A 30±1-hr. Ba isotope was prepared by irradiating Ba with neutrons from a cyclotron (cf. A., 1938, I, 594); it emits a 250-ke.v. group of electrons, strong γ-rays of ~250 ke.v., a soft complex spectrum of γ-rays, and *X*-rays corresponding with Ba *K* *X*-rays. 2·5-min. Ba was prepared by irradiating Ba with Li + ^2H neutrons (cf. Pool, A., 1937, I, 490). Ba (87±1 min.) was strongly activated by deuteron bombardment of Ba, and gave a β-ray upper limit of ~1 Me.v., and a γ-ray of ~0·6 Me.v. Cs bombarded with deuterons or neutrons gave a 180±10-min. rather than a 1·5-hr. period; the normal β-ray absorption spectrum indicates an upper limit of ~1 Me.v. Cs (20±1 months), apparently isomeric with ^{134}Cs (3 hr.), was prepared by neutron or deuteron bombardment of Cs; its normal β-ray spectrum had an upper limit of 0·9 Me.v., and there is fairly strong γ-radiation. N. M. B.

Nuclear fission. L. A. TURNER (Rev. Mod. Physics, 1940, **12**, 1—29).—A comprehensive review of investigations and interpretations of fission from the apparent discovery of transuranic elements in 1934, to the end of 1939, with a detailed bibliography. N. M. B.

Fission of uranium and thorium under deuteron bombardment. R. S. KRISHNAN and T. E. BANKS (Nature, 1940, **145**, 860—861).—Chemical separation of the recoil products obtained by Gant (A., 1940, I, 53) in the deuteron bombardment of U gave the following activities: Pt fraction, 15 min., 1 hr., and 30—40 hr.; Ba fraction, 11 and

80 min.; and La fraction, 4 hr. Some of these periods correspond with those obtained with neutron fission in U. Bombardment of the Th with 9-Me.v. deuterons gives radioactive nuclei of range equiv. to 1·8 cm. of air. The threshold for deuteron fission of Th is at $\sim$7·5 Me.v., and the fission cross-section increases rapidly between 8 and 9 Me.v. Chemical separation of the fission products gives the following periods: Pt fraction, 18 min. and 2·5 hr.; Ba fraction, 15 min.; and La fraction, 2·5 hr. L. S. T.

Fission products of uranium produced by fast neutrons. Y. Nishina, T. Yasaki, H. Ezoe, K. Kimura, and M. Ikawa (Nature, 1940, **146**, 24; cf. A., 1939, I, 592).—U_3O_8 has been bombarded with fast neutrons from Li + 3-Me.v. deuterons, and the Ag and Cd fractions separated as halide and sulphide, respectively, from the irradiated sample. The Ag fraction showed periods of 7·5 days and 3 hr., due probably to ^{111}Ag and ^{112}Ag, respectively. The Cd fraction showed periods of 50 min., 5·5 hr. (^{117}Cd), and 2·5 days (^{115}Cd). Neither Be + D neutrons from the cyclotron, and neutrons slowed down by paraffin, nor produce these activities to any appreciable extent. L. S. T.

Radioactive products from gases produced in uranium fission. G. N. Glasoe and J. Steigman (Physical Rev., 1940, [ii], **58**, 1—6; cf. A., 1939, I, 399).—Rb (15·4±0·2 min.) (max. β-particle energy 3·8 Me.v.) decaying to Sr (51±2 days), and Rb (17·8±0·2 min.) (max. β-particle activity 4·6 Me.v.) decaying to an apparently inactive end product, were observed. The parents are a gas with a few min. half-life and Kr (175±10 min.), respectively. Cs (32±0·5 min.) resulting from the decay of Xe (17±1 min.) has 2·6 Me.v. max. β-particle energy and produces Ba, inactive or of very long or short period. N. M. B.

Photo-fission of uranium and thorium. R. O. Haxby, W. E. Shoupp, W. E. Stephens, and W. H. Wells (Physical Rev., 1940, [ii], **58**, 92; cf. Roberts, A., 1939, I, 234).—γ-Rays from CaF_2 and AlF_3 targets bombarded with 2—3-Me.v. protons produced fission recoils from U and Th. The estimated cross-section for photo-fission is 10^{-26} sq. cm. compared with the theoretical val. 10^{-27} sq. cm. (cf. Bohr, *ibid.*, 595), and the estimated 2·9 Me.v. γ-ray yield from CaF_2 is 10^8 γ-quanta per 3×10^{13} protons which produce one fission. N. M. B.

Transformation of mesotrons into electrons. E. J. Williams and G. R. Evans (Nature, 1940, **145**, 818—819; cf. A., 1940, I, 143).—Photographs affording more evidence of the transformation of mesotrons into electrons are reproduced. L. S. T.

Creation of meson pairs by γ-rays and the "bremsstrahlung" of mesons in the nuclear field. M. Kobayasi and R. Utiyama (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 221—225).—Theoretical. The cross-section for the creation of a pair of positive and negative mesons by a photon of very high energy on collision with an at. nucleus, and the differential cross-section for the emission of a photon on collision between a meson of very high energy and an at. nucleus, have been calc. by the method of Weizsäcker and Williams. O. D. S.

East–west effect in Southern India. H. V. Neher (Physical Rev., 1938, [ii], **53**, 328—329).—One fourth of the total radiation at 7800 ft. in southern India is due to positrons. The charged particles responsible for the West excess are of the same nature as those that give the latitude effect, viz., electrons. L. S. T.

Latitude effect for cosmic-ray showers. W. H. Pickering and H. V. Neher (Physical Rev., 1938, [ii], **53**, 329).—Latitude effects for vertical rays are 14·5% in the East Indies and 10% in the Pacific Ocean. Showers show a smaller latitude effect (6% in the East Indies). L. S. T.

Energy losses of Pauli–Weisskopf particles. J. F. Carlson (Physical Rev., 1938, [ii], **53**, 330).—Various methods of energy loss for particles satisfying the Pauli–Weisskopf scalar equation have been investigated. L. S. T.

Preliminary experiments with a cosmic-ray telescope. W. H. Pickering (Physical Rev., 1938, [ii], **53**, 335).—Astronomical effects on cosmic radiation have been investigated by means of an equatorially mounted Geiger-counter telescope. L. S. T.

Bursts in cosmic-ray ionisation in the equatorial zone. S. A. Korff (Physical Rev., 1938, [ii], **53**, 914).—Bursts in the intensity of ionisation produced by cosmic radiation at various altitudes in this zone have been examined and analysed. Certain relationships are pointed out. L. S. T.

Galactic rotation and the variation of cosmic-ray intensity. I. A. Getting (Physical Rev., 1938, [ii], **53**, 914).—Evidence in support of a small sidereal variation in the intensity of cosmic radiation as a result of galactic rotation is described. L. S. T.

Method of identifying the primary cosmic rays. E. J. Schremp (Physical Rev., 1938, [ii], **53**, 915). L. S. T.

Equilibrium of the components of cosmic radiation at sea level. G. Cocconi and V. Tongiorgi (Physical Rev., 1940, [ii], **57**, 1180—1181).—Absorption measurements, corr. for side showers, in 0—10 cm. of Pb at different zenith inclinations indicate that equilibrium between the hard and soft components is not reached at sea level, but only under a layer equiv. to $\sim$12 m. H_2O. N. M. B.

Photographic plates as detectors of mesotron showers. D. M. Bose and (Miss) B. Chowdhry (Nature, 1940, **145**, 894—895).—Untreated photographic plates exposed in cardboard containers at heights of 2130 m. and 3660 m. in India show various tracks attributed mainly to secondary mesotrons. L. S. T.

Absorption of heavy cosmic-ray particles. W. Heitler, C. F. Powell, and H. Heitler (Nature, 1940, **146**, 65).—Further measurements on the Jungfraujoch material (cf. A., 1939, I, 594) of the absorption curve in Pb show that there are at least two components of cosmic radiation that produce heavy tracks. The first is very little absorbed in Pb, and probably consists of neutrons; the second has a transition curve in Pb similar to that of the soft radiation, which is regarded as responsible for part

of the heavy tracks, and for the max. obtained on the absorption curve. The process by which these tracks are produced is assumed to be the direct nuclear photo-electric effect. L. S. T.

Specific ionisation of cosmic-ray particles. R. L. SEN GUPTA (Nature, 1940, **146**, 65—66).—Measurements of the sp. ionisation of cosmic-ray particles over the energy range $2 \times 10^6 - 6 \times 10^9$ e.v. are recorded and discussed. L. S. T.

Cosmic-ray intensities in relation to cyclones and anticyclones. Y. NISHINA, Y. SEKIDO, H. SIMAMURA, and H. ARAKAWA (Nature, 1940, **146**, 95).—Variations of cosmic-ray intensities due to cyclonic migration have now been obtained free from seasonal effects. Previous conclusions (A., 1940, I, 279) are confirmed. L. S. T.

Volcanism and nuclear chemistry. II. M. NOETZLIN (J. Phys. Radium, 1940, [iii], **1**, 124—132; cf. A., 1940, I, 242).—Theoretical. W. R. A.

Theory of neutron-deuteron impacts. W. E. LAMB, jun., and R. SERBER (Physical Rev., 1938, [ii], **53**, 215).—A method has been developed for the treatment of such three-body problems as the collision of slow neutrons with deuterons in which the range of forces is treated as negligible in comparison with the size of the deuteron. L. S. T.

Estimates of the age of the planet from isotope ratios. A. BRAMLEY (Physical Rev., 1938, [ii], **53**, 323). L. S. T.

Possible deviations from the evaporation model of nuclear reactions. H. A. BETHE (Physical Rev., 1938, [ii], **53**, 675).—Many particles produced in reactions with heavy nuclei may have energies $>$ those calc. on the assumption of uniform nuclear temp., although $\ll$ the energy of the incident particle. L. S. T.

Electron-pair theory of heavy particle interaction and the Rabi effect. R. E. MARSHAK and H. A. BETHE (Physical Rev., 1938, [ii], **53**, 677). L. S. T.

Hartree approximation method for calculating nuclear energies. V. F. WEISSKOPF (Physical Rev., 1938, [ii], **53**, 680—681).—A method is described for estimating the order of magnitude of the successive approximations to the nuclear energy as given by the Hartree method. L. S. T.

Multiple radiation probabilities in light nuclei. M. PHILLIPS (Physical Rev., 1938, [ii], **53**, 681). L. S. T.

Theory of the emissivity of metals. E. GUTH (Physical Rev., 1938, [ii], **53**, 682).—A discussion. L. S. T.

Heavy particle interactions. D. R. INGLIS (Physical Rev., 1938, [ii], **53**, 686). L. S. T.

Alternative description of the compound nucleus. H. A. BETHE and E. J. KONOPINSKI (Physical Rev., 1938, [ii], **53**, 688; cf. A., 1938, I, 225).—Difficulties in the usual formulation of the theory of the compound nucleus are avoided by expanding the compound wave function as a sum of products of wave functions of residual nucleus and incident particle. L. S. T.

Proposed new mechanism in excited neon. E. W. PIKE (Physical Rev., 1938, [ii], **53**, 920). L. S. T.

Classical theory of point dipoles. H. J. BHABHA (Nature, 1940, **145**, 819—820).—The author's classical theory of mesons (A., 1939, I, 547) has been extended to the rotation and translation of a point dipole. L. S. T.

General theory of spectra. I. M. H. STONE (Proc. Nat. Acad. Sci., 1940, **26**, 280—283).—Mathematical. General functions of operators and calculus applicable to algebraic spectral theory are defined. L. J. J.

Photomagnetic disintegration and magnetic moment of the deuteron in the meson theory. S. T. MA (Proc. Camb. Phil. Soc., 1940, **36**, 351—362).—The interaction between an external electromagnetic field and a nuclear system can be expressed in terms of the multipole moments. The electric quadrupole and magnetic dipole moments of the deuteron are calc., taking meson theory exchange forces into account. The cross-section for the photomagnetic effect is $\sim$0·1 that for the photo-electric effect for energy 2·65 Me.v.; the former effect has a max. at $\sim$2·35 Me.v. L. J. J.

Heavy electron pair theory of nuclear forces. R. E. MARSHAK (Physical Rev., 1940, [ii], **57**, 1101—1106).—Mathematical. In view of difficulties arising from Bethe's neutral meson field theory of nuclear forces, the consequences of a heavy electron pair theory of nuclear forces are investigated. The heavy electrons are assumed to be identical with electrons except that their rest mass is taken as equal to the cosmic-ray meson mass. N. M. B.

Continuum theory of the compound nucleus. H. A. BETHE (Physical Rev., 1940, [ii], **57**, 1125—1144).—Mathematical. The region of dense levels can be treated by dispersion theory, or by statistical theory in which the total cross-section is expressed in terms of the probability that an incident particle hitting the nucleus will stick to it and form a compound nucleus (sticking probability). In the absence of a definition of "high"- and "low"-energy particles (requiring different assumptions for the probability) and a general treatment of both cases, a theory of sticking probability is given from a consideration of dense levels leading to a continuum theory, disregarding effects of individual levels. N. M. B.

Wave functions in crystals. C. HERRING (Physical Rev., 1940, [ii], **57**, 1169—1177).—Mathematical. An improved method is developed for calculating the eigenfunctions and energy vals. of an electron in a crystal lattice by solving a secular equation with wave functions χ_k which are simply plane waves made orthogonal to the core eigenfunctions. N. M. B.

Eigenvalue problem of the Dirac electron. A. LANDÉ (Physical Rev., 1940, [ii], **57**, 1183—1184; cf. A., 1939, I, 595).—Mathematical. N. M. B.

Spin angular momenta of elementary particles. E. L. HILL (Physical Rev., 1940, [ii], **57**, 1184).—Mathematical. N. M. B.

Dynamics of complex fission. R. D. PRESENT and J. K KNIPP (Physical Rev., 1940, [ii], **57**, 1188—1189).—Discrepancies between results previously reported (cf. A., 1940, I, 280) and those of Bohr (cf. A., 1939, I, 595) are explained. N. M. B.

Field theory of nuclear forces. C. L. CRITCHFIELD and W. E. LAMB, jun. (Physical Rev., 1940, [ii], **58**, 46—49).—Mathematical. The method applied to the electron–positron field theory of nuclear forces (cf. A., 1939, I, 595) is extended to take account of effects dependent on the rest mass of the field particles. N. M. B.

Effect of the nuclear Coulomb field on the capture of slow mesons. S. TOMONAGA and G. ARAKI (Physical Rev., 1940, [ii], **58**, 90—91).—The probability of a meson being captured in Pb, Al, and air before and after being brought to rest is calc. For negative mesons the capture probability is always > the disintegration probability, but almost all positive mesons will disintegrate spontaneously because of the very small capture probability due to the potential barrier. These results appear to explain the absence of disintegration electrons when negative meson tracks terminate in a cloud chamber (cf. Nishina, A., 1938, I, 57; Montgomery, A., 1939, I, 594). N. M. B.

Thomas–Fermi–Dirac equation. K. UMEDA (Physical Rev., 1940, [ii], **58**, 92—93; cf. Slater, A., 1935, 679).—The procedure for an accurate general solution is outlined. N. M. B.

Mass centre in relativity. (A) A. D. FOKKER. (B) M. BORN and K. FUCHS (Nature, 1940, **145**, 933; cf. A., 1940, I, 280). L. S. T.

Evolution of the stars. (A) G. GAMOW. (B) R. A. LYTTLETON and F. HOYLE (Nature, 1940, **146**, 97, 97—98; cf. A., 1939, I, 595).—(A) A reply to criticism (*ibid.*, 1939, **144**, 1019). (B) A reply to (A). L. S. T.

Absorption of air in the extreme ultra-violet. E. G. SCHNEIDER (J. Opt. Soc. Amer., 1940, **30**, 128—132).—To maintain const. intensity, a many-line spark source is used instead of a continuous spectrum; air absorption coeffs. at ~350 points for 380—1600 A. are tabulated. Photographic measurements with oiled plates show strong absorption for 1600—1300 A., a transparent region for 1300—1000 A., and a highly absorbing group of bands at shorter λλ, poorly resolved but showing extreme fine structure. N. M. B.

Transmission factors of ultra-violet radiation through water. F. BENFORD (J. Opt. Soc. Amer., 1940, **30**, 133—135).—Using a quartz Hg-arc lamp and a photo-electric receiving cell in a small test tank, a simple general analysis of the transmission factors is developed. N. M. B.

New band of OD at 2963 A. K. R. RAO and M. G. SASTRY (Current Sci., 1940, 9, 225).—A new band at 2963 A., with doublet P, Q, and R branches characteristic of the $^2\Sigma^+ \rightarrow {}^2\Pi_{inv.}$ transition, is reported and its rotational structure analysed. It is the 3 → 2 band of OD, of which the 2 → 1 band at 2916 A. was recently reported (A., 1940, I, 310). Vibrational and rotational coeffs. are given. W. R. A.

Spectroscopic measurements of gaseous CN. II. Thermal dissociation of cyanogen. J. U. WHITE (J. Chem. Physics, 1940, **8**, 459—465).—The absorption spectrum of free CN radicals (A., 1940, I, 92) has been observed at 1500° K., and from the lower limit of the abs. absorption coeff. the partial pressure has been calc. Hence the equilibrium const. for $C_2N_2 \rightarrow 2CN$ is calc. as $K_{1500°\,K.} = 1{\cdot}1 \times 10^{-12}$ and $\Delta H = 138{\cdot}1 \pm 1$ kg.-cal. The most probable f val. for the $^2\Sigma \rightarrow {}^2\Sigma$ transition of CN is 0·1 and, from this, $\Delta H = 146 \pm 4$ kg.-cal. From the partial pressure of CN at ~400° the thermal polymerisation of C_2N_2 is due to the addition of the free radicals to C_2N_2. From these data the heat of vaporisation of graphite is 169·2 kg.-cal. and the heat of dissociation of CO is 11·054 v., but these vals. cannot be advanced with complete certainty. W. R. A.

Absorption spectra of diatomic fluorides in the carbon-tube furnace. F. A. JENKINS and G. D. ROCHESTER (Physical Rev., 1938, [ii], **53**, 213; cf. A., 1938, I, 58).—The spectra of the fluorides of Be, Zn, Cd, Al, Ti, Sn, Pb, Sb, Bi, Cr, Mn, and Fe vaporised at 1000—2000° have been examined in the region 5000—2000 A., and several new band systems found. SnF shows five doublet band systems and two continua; the Sn isotope effect is well resolved. Metallic Cu, Mn, Al, and Sn gave no mol. spectra. Two new band systems and a continuum all at <2500 A. have been found with AgCl. L. S. T.

Ultra-violet band systems of GeSe and GeTe, and their relations to those of similar molecules. R. F. BARROW and W. JEVONS (Proc. Physical Soc., 1940, **52**, 534—546; cf. A., 1940, I, 281).—The spectra were obtained in emission in SiO_2 discharge tubes. Data for 23 band heads of GeSe (λλ 3170—3570) and for 29 of GeTe (λλ 3380—3830) are reported. Equations for the band heads are given. Measurements only were made of a no. of weak bands, probably due to a second GeSe system, in the region λλ 3060—2660. The bands are degraded to the red and show strong vibrational isotope effect. From ground-state data for 19 of the 20 group IV*b* + group VI*b* mols. the trends of the vibrational frequencies, force consts., energies of dissociation, and internuclear distances are discussed. N. M. B.

Ultra-violet absorption systems of benzene vapour. G. NORDHEIM, H. SPONER, and E. TELLER (J. Chem. Physics, 1940, **8**, 455—458).—The absorption systems of C_6H_6 vapour between 1650 and 2700 A. are discussed and the following assignments are made: the bands at 2050—1850 A. arise from a forbidden transition of symmetry $^1A_{1g} \rightarrow {}^1B_{1u}$; the much more intense bands at 1650—1850 A. to an allowed $^1A_{1g} \rightarrow {}^1E_u^-$ transition accompanied by a transition involving a C–H dissociation which is responsible for the continuous background in this region. Both observed Rydberg series belong to allowed $^1A_{1g} \rightarrow {}^1E_u^-$ transitions. W. R. A.

Near ultra-violet absorption spectrum of benzene. W. F. RADLE and C. A. BECK (J. Chem. Physics, 1940, 8, 507—513).—Wave nos. and relative intensities of 500 absorption bands of C_6H_6 vapour in the 2600 A. region have been determined. Assign-

ments of several bands have been made and the variation in intensities of principal bands of the A, B, and D progressions has been investigated. The A_0^0 band is assigned to the ground state, the B_0^0 and C_0^0 bands to 606 cm.$^{-1}$ and 2×606 cm.$^{-1}$ vibrational states respectively. Calc. and experimental intensities throughout the range $-35°$ to $250°$ are in good agreement. W. R. A.

Ultra-violet absorption spectra of nitrogenous heterocyclic compounds. I. Effect of p_H and irradiation on the spectrum of adenine. J. R. Loofbourow and (Miss) M. M. Stimson (J.C.S., 1940, 844—848).—Adenine (I) can undergo tautomerism of the amidine type $-N{:}\dot{C}{\cdot}NH_2 \rightleftharpoons {\cdot}NH{\cdot}\dot{C}{:}NH$, and is influenced by p_H. The change brings about different weighting in the mol. and the absorption spectrum, and thus changes in extinction and λ with change in p_H. This is contrary to the data of Gulland and Holiday (A., 1936, 1000) but agrees with those of Warburg *et al.* (A., 1936, 377). (I) is stable to ultra-violet radiation for $\gt 4$ hr. W. R. A.

Absorption spectra of metallic complex salts of 2 : 2′-dipyridyl. III. K. Yamasaki (Bull. Chem. Soc. Japan, 1940, **15**, 130—136).—The following complex Co^{II} salts containing 2 : 2′-dipyridyl (R) are described : $(H_2R)[CoCl_4]$ (blue); $[CoR]Cl_2$ (two modifications, α green and β blue-violet); $[CoR]Cl_2,H_2O$ (pink); $[CoR]Cl_2,4H_2O$ (red). Extinction curves (700—200 mμ.) for the solid substances and their EtOH solutions are given. F. J. G.

Colour phenomena associated with quinquevalent molybdenum solutions. I. Absorption spectra in solutions of various hydrochloric acid concentrations. C. F. Hiskey and V. W. Meloche (J. Amer. Chem. Soc., 1940, **62**, 1819—1824).—The effects of electrolytes and of temp. on the colours of HCl solutions of Mo^V have been studied colorimetrically. To explain the results it is necessary to postulate the existence in these solutions of two additional components besides those responsible for the green and amber colours. A colorimetric procedure for the determination of Mo in semi-micro-amounts is given. F. J. G.

Effects of pressure, temperature, and chemical composition on the absorption of light by mixtures of aromatic amines and nitro-compounds. R. E. Gibson and O. H. Loeffler (J. Amer. Chem. Soc., 1940, **62**, 1324—1334).—The absorption bands of solutions of aromatic amines in NO_2- or NO-compounds are shifted to longer λ by an increase in pressure at const. temp., or by a rise in temp. at const. vol., whereas the effect of a change of temp. at const. pressure is variable. It is suggested that the colours of the solutions arise from the mutual polarisations of the mols. when appropriate groups are near one another, these polarisations being primary steps in possible reactions (oxidation and reduction) involving electron transfer from the NH_2 to the O atoms of the NO_2- or NO-groups. This is confirmed by the observation that substituents in the amine or in the NO_2-compound affect the light absorption in a manner parallel to their effects on the electron mobility of the NH_2 or on the ease of reduction of the NO_2, respectively. J. W. S.

Hydrogen-ion concentration in aqueous solutions of complex cobaltammines and their absorption spectra. V. Aqueous solutions of complexes containing the oxalate radical. T. Uemura and N. Hirasawa (Bull. Chem. Soc. Japan, 1940, **15**, 161—166; cf. A., 1938, I, 399).—The absorption curves for $[CoX_2(H_2O)OH]K_2$, $[CoX(NH_3)_5]Cl,HCl$, $[CoX_3]K_3,H_2O$, $[CoX(NH_3)_4]Cl$, $[CoX_2(NH_3)_2]K,H_2O$, $[CoX(NH_3)_2(NO_2)_2]K,H_2O$, and $[CoX(NH_3)_3(H_2O)]Cl$ ($X = C_2O_4$) are recorded. All but the first two show selective absorption, the val. of the absorption max. and its λ being increased on increasing the no. of X radicals in the complex. Variations in p_H have only a slight effect on the absorption. D. F. R.

Absorption spectra of polynuclear complex salts. Y. Ohyagi (Bull. Chem. Soc. Japan, 1940, **15**, 186—195).—Absorption spectra of 18 Co complex salts which are stable in 90% H_3PO_4 are recorded. D. F. R.

Far ultra-violet absorption spectra of some aliphatic ketones. A. B. F. Duncan (J. Chem. Physics, 1940, **8**, 444—446).—The absorption spectra of $COMePr^{\alpha}$, $COMePr^{\beta}$, and $COEt_2$ have been measured from 2000 to 800 A., but only general absorption was found at $\lt 1500$ A. Between 1500 and 2000 A. three transitions were found (with $COEt_2$ one is unaccountably missing) and their vibrational structures are discussed and compared with those of $COMe_2$ and COMeEt. Most transitions are of a Rydberg type giving ionisation potentials of ~ 10 e.v. W. R. A.

Absorption law for total radiation measurements. W. P. Berggren (Physical Rev., 1940, [ii], **57**, 1183).—Mathematical. N. M. B.

Luminescence of pure crystals. D. H. Kabakjian (Physical Rev., 1938, [ii], **53**, 919).—Conditions under which pure crystals should luminesce are discussed. Many crystals can be made luminescent by using radioactive sources, and the luminescence of pure $RaBr_2$, $RaCl_2$, $RaSO_4$, $BaCl_2$, $BaBr_2$, and $BaSO_4$ has been examined. With the correct heat-treatment, max. luminescence in these crystals is produced with the purest crystal. The variations in brightness with the temp. of heat-treatment are not explained by theory. L. S. T.

Magnetism of phosphors. L. Sibaiya and H. S. Venkataramiah (Current Sci., 1940, **9**, 224—225).—The diamagnetism of phosphorescent powders increases when the powder is rendered luminescent, but uncertainty regarding the composition of the phosphor makes interpretation difficult. CaS–Bi phosphor, prepared from pure ingredients, phosphoresces with a blue colour when exposed to light. The variation in magnetic susceptibility with time of phosphorescence decay has been investigated. The increased diamagnetism during luminescence cannot be due to a temp. effect and is ascribed to the larger orbits circumscribing the phosphorescent centre on irradiation. W. R. A.

Spectroscopic study of deuterium bonds. W. Gordy (Physical Rev., 1938, [ii], **53**, 851).—Mixtures of D_2O with dioxan (I) and $COMe_2$ have been studied in the region 3—12 μ. (I) or $COMe_2$ shifts the intense 4-μ. band of D_2O to shorter $\lambda\lambda$ by $\sim$0·2 μ. In the most dil. solutions, the band appears at $\lambda\lambda >$ that of the corresponding band of D_2O vapour. In the change liquid $\rightarrow$ solution, the shift to shorter $\lambda\lambda$ probably indicates the rupture of D linkings between the D_2O mols. The appearance of the band at longer $\lambda\lambda$ in the solution than in the vapour state may be a result of the formation of D linkings between solute and solvent. L. S. T.

Long-wave-length absorption of the carbonyl group. H. L. McMurry and R. S. Mulliken (Proc. Nat. Acad. Sci., 1940, **26**, 312—317).—The characteristics of Burawoy's *R* chromophores can be explained by forbidden transitions from the normal state to singlet states involving the loosely-bound non-bonding electron pair in the O atom of the CO group. L. J. J.

Infra-red absorption spectra of the vapours of DCO_2H and DCO_2D. R. C. Herman and V. Williams (J. Chem. Physics, 1940, **8**, 447—449; cf. A., 1938, I, 554).—The spectra of the vapours of DCO_2H and DCO_2D have been examined from 1 to 15 μ. and resolved into spectra due to mono- and dimerides. Practically all bands <1700 cm.$^{-1}$ in the monomeride spectra show a doublet structure with a separation of 34 cm.$^{-1}$, but these bands cannot be interpreted unequivocally. W. R. A.

Potential function of acetylene. II. T. Y. Wu (J. Chem. Physics, 1940, **8**, 489—494).—Mathematical. The first- and second-order anharmonic potentials are calc. tentatively from the classification of C_2H_2 absorption bands given previously (cf. A., 1939, I, 242). W. R. A.

Absorption of phenyl mustard oil in the 4·8 μ. region. D. Williams (J. Chem. Physics, 1940, **8**, 513—516).—The absorption of different thicknesses of liquid PhNCS has been investigated near 4·8 μ.; the curves can be explained by the superposition of three bands with max. near 4·7, 4·8, and 5·1 μ. Examination of a 10% solution of PhNCS in CCl_4 gave two distinct max. at 4·68 and 4·82 μ. but the 5·1 μ. max. was not pronounced. The 4·68 and 4·82 μ. max. correspond with observed Raman displacements but the 5·1 μ. max. has no Raman counterpart. Liquid PhNCS was examined up to 15 μ., with results agreeing with Coblentz and showing a new band at 14·6 μ. Comparison of infra-red and Raman data show fair agreement. Infra-red frequencies at 1950, 1075, and 925 cm.$^{-1}$ have no Raman counterpart. The suggestion of Badger (A., 1937, I, 219) that the Raman displacements of 2172 and 2100 cm.$^{-1}$ arise from splitting caused by Fermi resonance between the N–C vibration and some other vibration which is a sub-multiple of the N–C frequency is discussed. Possible sub-miltiples are 1075, 1000, and 685 cm.$^{-1}$ but the first two are probably too weak to produce the effect. The 685 cm.$^{-1}$ frequency, due to a C–S bond vibration, appears to be the most likely to produce resonance. No evidence of Fermi splitting is revealed in the 2100 cm.$^{-1}$ region of the spectra of Me, Et, or Ph nitriles or carbylamines. W. R. A.

Spectroscopic evidence for hydrogen bonds: effect of chelation on the carbonyl frequency. W. Gordy (J. Chem. Physics, 1940, **8**, 516—519).—The infra-red absorption near 6·0 μ., due to the C·O group, has been investigated for $COPh_2$, *o*-$OH\cdot C_6H_4\cdot COPh$, MeOBz, *o*-$NH_2\cdot C_6H_4\cdot CO_2Me$, *o*-$OH\cdot C_6H_4\cdot CO_2Me$, PhCHO, and *o*-$OH\cdot C_6H_4\cdot CHO$. Introduction of an OH or NH_2 adjacent to C·O shifts the C·O absorption max. to longer $\lambda\lambda$ by 0·15—0·20 μ. and increases its intensity. Comparison of the spectra of $COMe_2$ and CH_2Ac_2 (I) in the region 5·4—6·5 μ. shows that there is a common band at 5·84 μ. and that (I) gives also a broad and stronger band at 6·16—6·30 μ. The latter is probably a superposition of the C·O and C·C bands of the enol form of (I). Similarly Et malonate and acetoacetate give weak bands at $\sim$6·1 μ., probably due to small amounts of enol forms, which is not shown by EtOAc. Energy changes in the proton-acceptor groups cannot be neglected in calculating the energy of H-bonding from spectroscopic data. W. R. A.

Infra-red absorption by the selenium hydrides. W. C. Sears, D. M. Cameron, and H. H. Nielsen (Physical Rev., 1938, [ii], **53**, 330).—The centres of the fundamental bands for H_2Se, using Dennison's notation, are ν_1 2300, ν_2 1110, and ν_3 2380 cm.$^{-1}$ The rotational spacings in all three bands are $\sim$7·8 cm.$^{-1}$ For HDSe, ν_1 is 1610, ν_2 910, and ν 2385 cm.$^{-1}$; the rotational spacings for ν_2 and ν_3 are $\sim$5·5 cm.$^{-1}$ For D_2Se, ν_2 occurs near 760 cm.$^{-1}$ and ν_3 at 1700 cm.$^{-1}$; the spacings for ν_2 are $\sim$4·0 cm.$^{-1}$ L. S. T.

Infra-red and Raman spectra of polyatomic molecules. XII. Methylacetylene. B. L. Crawford, jun. (J. Chem. Physics, 1940, **8**, 526—531).—The infra-red absorption of gaseous CHMe⋮CH has been investigated from 2·5 to 25 μ. and the data, in conjunction with existing Raman data (A., 1939, I, 180) for the liquid state, enable a complete vibrational analysis to be made. A normal co-ordinate treatment has been carried out in which all force consts. were determined *a priori* from other mols. Thermodynamic properties of CHMe⋮CH as a perfect gas at 1 atm. are given from 250° to 1000° K. W. R. A.

Infra-red spectrum of methyl mercaptan. H. W. Thompson and N. P. Skerrett (Trans. Faraday Soc., 1940, **36**, 812—817).—The spectrum of MeSH has been measured over the range 1—16 μ. and the results are correlated with Raman data. The observed frequencies have been satisfactorily assigned to the normal modes, with the exception of the frequency relating to the internal torsional motion about the C–S bond. Interpretations are suggested for combinations and overtones in the infra-red. F. L. U.

Infra-red and Raman spectra of ethylene sulphide. H. W. Thompson and D. J. Dupré (Trans. Faraday Soc., 1940, **36**, 805—812).—Infra-red ($\lambda\lambda$ 1—17 μ.) and Raman spectra of $(CH_2)_2S$ have been measured and compared. With one exception a satisfactory interpretation is given for each combin-

ation band. Some data on the ultra-violet absorption between 4000 and 2000 A. are recorded. F. L. U.

Infra-red spectrum of zinc dimethyl. H. W. Thompson, J. W. Linnett, and F. J. Wagstaffe (Trans. Faraday Soc., 1940, **36**, 797—805; cf. A., 1937, I, 442).—The infra-red spectrum of $ZnMe_2$ has been studied between λλ 1 and 17 μ. Correlation of the data with Raman data indicates the eclipsed linear structure D_{3h} as the most probable. Internal rotation is restricted, but the mol. is not very rigid towards torsion, and the potential barrier between this state and that of free rotation may be small. F. L. U.

Raman effect in gases at atmospheric pressure. I. J. Cabannes and A. Rousset (J. Phys. Radium, 1940, [viii], **1**, 155—160).—The Raman spectra of H_2, N_2, O_2, CO, NO, CO_2, N_2O, and NH_3 at atm. pressure and the depolarisation factors of the Raman lines are discussed. An interpretation of the results in terms of the electronic structure of the mols. is attempted. W. R. A.

Raman effect in Rochelle salt crystals. T. M. K. Nedungadi (Proc. Indian Acad. Sci., 1940, **11**, **A**, 413—421).—A single crystal of Rochelle salt (I) gives 25 Raman displacements and 4 H_2O bands and the results are compared with those for aq. solutions of (I) and Na tartrate and for tartaric acid crystals. Raman lines undergo marked changes in intensity for different orientations of the crystal even when the incident light is unpolarised; lines which undergo marked change are symmetrical oscillations, whilst unsymmetrical oscillations show no change. Four lines characteristic of the cryst. lattice are reported. W. R. A.

Raman spectra of some inorganic compounds. J. R. Nielsen, N. E. Ward, and H. Dodson (Physical Rev., 1938, [ii], **53**, 331).—The spectra of aq. $NaBO_2$ (I), $Na_2B_4O_7$ (II), and $NaAlO_2$, of cryst. (I), (II), H_3BO_3, Cd, Hg, and Zn halides, and KCNO have been investigated. With aq. (I) long exposures give two faint, diffuse frequencies additional to the one reported previously (A., 1937, I, 219). BO_2' cannot be triat. and linear as assumed previously (*loc. cit.*). New frequencies were found with most of the crystals. L. S. T.

Raman effect and problems of constitution. XV. Rotation isomerism in dissolved αβ-di-iodoethane. L. Kahovec and K. W. F. Kohlrausch (Ber., 1940, **73**, [*B*], 159—162).—The Raman spectra of cryst. $(CH_2I)_2$ and its Et_2O solution (1 g. in 4 c.c.), which are recorded, are closely similar to the corresponding spectra of $(CH_2Br)_2$ and $(CH_2Cl)_2$ (cf. Mizushima *et al.*, A., 1939, I, 121; 1940, I, 9). In each case the no. of lines is increased in the liquid or solution owing to rotation isomerism; only the *trans* form occurs in the solid, but *trans* and *cis* forms exist in the liquid or solution. A. J. E. W.

Raman effect and dipole moment in relation to free rotation. XII. Raman spectra of ethylene chlorohydrin, *n*-propyl chloride, and *n*-butane in the liquid and solid states. S. Mizushima, Y. Morino, and S. Nakamura (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 205—215).—Raman spectra of solid and liquid $Cl\cdot[CH_2]_2\cdot OH$, Pr^aCl, and C_4H_{10} have been measured and are compared with each other and with existing data. The solid state exhibits fewer lines than the liquid state and it is suggested that in the liquid state these mols. are present in a dynamic equilibrium of two forms, only one of which is stable in the solid state. W. R. A.

Raman spectra of amino-acids and related compounds. V. Deuterium substitution in the amino-group. J. T. Edsall and H. Scheinberg (J. Chem. Physics, 1940, **8**, 520—525).—Raman spectra of NH_2Me, ND_2Me, $NH_3^{\cdot}Me$, $ND_3^{\cdot}Me$, $(\cdot NH_3)_2^{\cdot\cdot}$, $(\cdot ND_3)_2^{\cdot\cdot}$, $NH_2\cdot NH_3^{\cdot}$, and $ND_2\cdot ND_3^{\cdot}$ are recorded. D-substitution in the NH_2 shows (i) that H analogues have frequencies 1·36 times those of corresponding D analogues, (ii) that Me frequencies are unaltered, and (iii) that some frequencies are changed, *e.g.*, C–N and N–N stretching vibrations, by < the 1·36 factor. D-substitution was carried out by dissolving the H analogues in D_2O and removing water by evaporation in a vac. over P_2O_5. W. R. A.

Raman effect and chemical constitution. Influence of constitutive and other factors on the double linkings of organic compounds. IV. Frequency of the ethylenic double linking in unsaturated carbonyl compounds. G. V. L. N. Murty and T. R. Seshadri (Proc. Indian Acad. Sci., 1940, **11**, **A**, 424—428).—Close similarity is observed between the Raman spectra of $CHPh\dot{:}CH\cdot CH_2\cdot OH$, $CHPh\dot{:}CH\cdot CH_2\cdot OAc$ (I), and $CHPh\dot{:}CH\cdot CO_2Et$ (II). The higher $C\dot{:}C$ and $C\dot{:}O$ frequencies in (I) and $CH_2\dot{:}CH\cdot CH_2\cdot OAc$ in comparison with (II) and $CH_2\dot{:}CH\cdot CO_2Et$ are ascribed to the existence of resonance in the latter. $C\dot{:}C$ and $C\dot{:}O$ are mutually weaker when present in conjugation. H. W.

Raman spectrum of thiocyano-compounds and structure of the thiocyanate group. J. Goubeau and O. Gott (Ber., 1940, **73**, [*B*], 127—133).—MeNCS gives Raman lines at 1087, 2106, and 2218 cm.$^{-1}$, which are ascribed to the NCS group. HCNS gives NCS lines at 801 and 2017 cm.$^{-1}$ (in Et_2O) or 848 and 2038 cm.$^{-1}$ (in CCl_4 and CS_2); with the Et_2O solution changes occur in the Et_2O lines which correspond with those in similar solutions of HCl and HBr. A comparison of the bond strengths with the calc. vals. for the structures $\cdot S\cdot C\vdots N$ (I) and $\cdot N\dot{:}C\dot{:}S$ (II) indicates that HCNS in CCl_4 and MeNCS have structure (II) with no detectable mesomerism. In other cases [MeCNS, $Hg(CNS)_2$, KCNS, $Ba(CNS)_2$, and HCNS in Et_2O] mesomerism occurs between (I) and (II); this explains certain divergent observations on the reactions of HCNS. Solid HCNS is probably polymerised. The approach to structure (I) is closest in metallic salts. The marked difference between CNS and CNO, in which there is no mesomerism (cf. A., 1935, 851), is probably due to fixation of the electron structure by the less polarisable O atom, and the smaller difference of electron affinity between S and N as against O and N. A. J. E. W.

Raman effect and problems of constitution. XVI. 1- and 2-Methylated benztriazole and indazole. K. W. F. Kohlrausch and R. Seka (Ber., 1940, **73**, [*B*], 162—166; cf. A., 1938, I, 556).—Raman data for 1- and 2-methyl-benztriazole and

-indazole, and additional lines for 2-methylbenziminazole and indazole, are reported. The spectra confirm that the 1-Me derivatives (with 1-methylbenziminazole) possess similar structures to the parent compounds but marked differences in the line distribution suggest that some different mode of linking occurs in both rings of the 2-Me compounds (including 2-methylindole). A. J. E. W.

Ionisation and dissociation by electron impact in CCl_2F_2 and in CCl_4 vapour. R. F. BAKER and J. T. TATE (Physical Rev., 1938, [ii], **53**, 683).—The relative abundances and the appearance potentials of the ions formed in these gases at an electron energy of 75 e.v. are tabulated. The process $CCl_4 \rightarrow CCl_3^+ + Cl^-$ is a probable one. An upper limit of 1·7 v. is fixed for the electron affinity of Cl_2. The heat of formation calc. for CCl_2F_2 is 108±23 kg.-cal. (4·7±1 v.). L. S. T.

Dipole moments and structures of the esters of some fatty and some inorganic acids. G. L. LEWIS and C. P. SMYTH (J. Amer. Chem. Soc., 1940, **62**, 1529—1533).—From measurements on dil. solutions in C_6H_6 or C_7H_{16} the following moments (μ), in D., have been determined at 25°: $C_{10}H_{21}\cdot CO_2Et$ (I) 1·89, $C_{15}H_{31}\cdot CO_2Et$ (II) 1·87, $C_{17}H_{35}\cdot CO_2Et$ (III) 1·88, $Pr^a{}_3BO_3$ 0·77, $Bu^\beta{}_3BO_3$ 0·85, *sec.*-Bu_3BO_3 0·85, Ph_3PO_3 2·02, Ph_3PO_4 2·81, and Ph_3PO_3S 2·58. The vals. for (I), (II), and (III), which are identical with those for $EtCO_2Et$ and $PrCO_2Et$, confirm that the long chain does not affect the μ of the mol. or hinder its free orientation at 25° in a field of frequency 50 kilocycles. Equations are derived to calculate the resultant moments of the other esters on the assumption of equal probability of all positions of rotation about the B–O and P–O linkings. Steric repulsion between the alkyl groups in the borates lowers μ to <0·5 of the vals. calc. on the basis of free rotation as well as on that of B–O linkings stiffened by double linking character. Agreement is obtained between the observed and calc. vals. for Ph_3PO_3 where steric hindrance plays a minor rôle. The approx. moment vals. of the bonds are P–O 1·2, P→O 3·5, P→S 3·2. J. W. S.

Calculation of dipole moments from rates of nitration of substituted benzenes and its significance for organic chemistry. T. RI and H. EYRING (J. Chem. Physics, 1940, **8**, 433—443).—Since (*a*) *o*- and *p*-orienting substituents increase the electron density on the corresponding C atoms, and (*b*) substituting agents, being electrophilic, react most easily with that C which is surrounded by the greatest no. of electrons, the charge distribution and dipole moments (μ) of mono-substituted benzenes can be calc. from reaction rates and give vals. in good agreement with observed vals. From vals. of μ for aromatic and aliphatic compounds the % of *o*-, *m*-, and *p*-derivatives obtained by nitration of various mono-substituted benzenes have been calc. and agree well with observed vals. Nitration of C_6H_6 is an ionic reaction in which the nitrating agent forms a $NO_2^{\cdot}$ ion which reacts with the reacting C. The activation free energy is reduced by the amount of electrostatic interaction and is, thus, dependent on the charge on the reacting C, the distance (r) between $NO_2^{\cdot}$ and the reacting C, and the dielectric const. (D) of the medium between $NO_2^{\cdot}$ and C. It is found that $r \simeq 1{\cdot}64$ A. and $D \simeq 1$, irrespective of the reacting medium. Conversely, reaction rates can be calc. from vals. of μ. W. R. A.

Electric moment of *iso*oxazoles. G. TAPPI and C. SPRINGER (Gazzetta, 1940, **70**, 190—196).—Vals. of ϵ, n, d, and μ for a no. of *iso*oxazoles in C_6H_6 at 25° are recorded. The structure of the C_3NO ring is discussed. O. J. W.

Refractivity of formamide. G. F. SMITH (J.C.S., 1940, 869—870).—Vals. of n_{20} for $HCO\cdot NH_2$ are given for 20 λλ between 6708 and 4358 A. and $n^2 = 1{\cdot}63709 + 0{\cdot}41561\lambda^2/(\lambda^2 - 0{\cdot}03230)$ gives vals. in fair agreement with experimental vals. but it is unlikely that it will hold outside the visible spectrum. $[R_L] = 10{\cdot}629$. W. R. A.

Magnetism and valency: manganese compounds. N. GOLDENBERG (Trans. Faraday Soc., 1940, **36**, 847—854).—Literature dealing with magnetic moments (M) of simple and complex Mn salts is surveyed. M has been measured for the following: $K_5Mn(CN)_6$, NH_4MnPO_4,H_2O, $K_2Mn(C_2O_4)_2,2H_2O$, $KMn(CN)_3$, $K_4Mn(CN)_6,3H_2O$, $K_3Mn_2(CN)_9,4KOH$, $K_3Mn(CN)_6$, $MnPO_4,H_2O$, $Mn(OAc)_3,2H_2O$, $K_3[Mn(C_2O_4)],3H_2O$, $NH_4[Mn(O\cdot C_6H_4\cdot CO_2)_22H_2O],2H_2O$, $K_2Mn(IO_3)_6$, $BaMnO_4$. M vals. of the Mn salts so far studied, except the complex cyanides, are almost exactly those of the Mn ions present, and thus indicate the electrostatic nature of the linkings. M for the double cyanides indicate direct covalent binding of the co-ordinated CN groups. F. L. U.

Stability towards racemisation of optically active compounds, with special reference to tervalent nitrogen compounds. J. F. KINCAID and F. C. HENRIQUES, jun. (J. Amer. Chem. Soc., 1940, **62**, 1474—1477).—Approx. calculations from spectroscopic data indicate that the energy of activation (ΔE) of the racemisation of compounds of the type NRR′R″ is so low that they cannot be resolved at room temp. Substitution derivatives of $(CH_2)_2NH$ and P^{III} compounds have higher ΔE, and so should be capable of resolution. It is also shown that ΔE for the racemisation of sulphonium compounds through an intramol. conversion is very high, thereby confirming that the racemisation involves dissociation of the SR_3X mol. into SR_2 and RX. It is concluded that the activated complex in the racemisation of compounds of the type CRR′R″R‴ cannot have a planar structure, and hence that the change must occur through some process involving the breaking of a linking attached to the central atom. J. W. S.

Structural principles of inner complex salts. P. PFEIFFER (Angew. Chem., 1940, **53**, 93—98).—A review. R. S. C.

Mesomerism. R. C. EVANS (Chem. and Ind., 1940, 518—521).—A review and discussion.

Mesomerism and the uncertainty principle. (A) G. N. COPLEY. (B) C. A. REDFARN (Chem. and Ind., 1940, 559, 560).—Criticisms of the above. L. J. J.

Rotational transition in solid methane. J. A. Wheeler and C. V. Cannon (Physical Rev., 1938, [ii], **53**, 684—685). L. S. T.

Stability of the tetrahedral angle at a carbon atom. Relationships between valency angle and isomorphous replacement with bivalent atoms and pseudo-atoms.—See A., 1940, II, 305.

Interaction between nitrogen molecules. J. Corner (Trans. Faraday Soc., 1940, **36**, 780—781).—The hitherto accepted vals. of the consts. ϕ_0 and r_0 in the expression $\phi = 12\phi_0\{1/12(r_0/r)^{12} - \frac{1}{6}(r_0/r)^6\}$ for the ntermol. potential in the case of N_2 lead to anomalous results in the calculation of some properties. New vals. have now been calc. from recent virial and Joule–Thomson data, and the anomalies eliminated. F. J. G.

Energy and entropy of liquid surfaces. H. Campbell and D. D. Eley (Trans. Faraday Soc., 1940, **36**, 854—856).—An approx. linear relationship exists between $\Delta S_{mol.} = -(\partial\mu/\partial T)_p$ and $\Delta E_{mol.} = \mu - T(\partial\mu/\partial T)_p$, where μ denotes the mol. surface free energy $= \sim\gamma(M/\rho)^{\frac{2}{3}}$. F. L. U.

Lengths and strengths of atomic bonds. (Miss) D. Wrinch and D. Harker (J. Chem. Physics, 1940, **8**, 502—503).—The prep. of length–strength curves for linkings between pairs of atoms is advocated and illustrated. From these curves, by summation, the heat of formation of a compound could be computed without reference to the nature of the linking. W. R. A.

Cohesion of liquids. R. S. Vincent (Nature, 1940, **145**, 970—971).—An apparatus in which tension is applied to liquids by means of a metallic bellows is described. The max. tension that EtOH, Et_2O, or lubricating oil will withstand for long periods is simply related to γ and v.p. The increase in this tension with a fall in temp. can be interpreted largely by the changes in γ and v.p. L. S. T.

Chemical detector for molecular beams. J. H. Simons and J. Glasser (J. Chem. Physics, 1940, **8**, 547—550).—A thin film of Te detects beams of at. H, O, Cl, and Br. A method of intensifying the image is described and applications for the detector are indicated. W. R. A.

Effect of temperature on the reflexion of *X*-rays from cadmium. W. M. Schwarz (Physical Rev., 1938, [ii], **53**, 919).—Intensities of reflexion of Cu $K\alpha$ radiation from powdered Cd crystals at room temp. and the temp. of liquid air have been recorded photographically. L. S. T.

***X*-Ray crystal structure study of tetramethylammonium tri-iodide.** R. C. L. Mooney (Physical Rev., 1938, [ii], **53**, 851—852).—NMe_4I_3, orthorhombic bipyramidal, has a_0 10·43, b_0 8·60, c_0 14·62 A.; space-group *Pnmn*. The I atoms lie in special positions in the reflexion plane perpendicular to the *y* axis, and three of them are associated to form a univalent complex anion group. This group is linear, with I—I 2·75 A. L. S. T.

Accuracy of lattice constant determination with particular reference to the asymmetric method. M. Straumanis (Österr. Chem.-Ztg., 1940, **43**, 1—13).—A survey of the development of wavelength, lattice const. formula, and apparatus is given. An improved method of temp. control is described. Measurements of the space lattice const. at 25° are recorded for pure Pb, Al, LiF, NaF, As_2O_3, TlCl, TlBr, Se, and Stassfurt rock-salt, and compared with existing data. W. R. A.

Anomalous *X*-ray reflexions on Laue photographs. I. E. Knaggs, K. Lonsdale, A. Müller, and A. R. Ubbelohde (Nature, 1940, **145**, 820—821).—Effects similar to those described by Raman *et al.* (A., 1940, I, 286) have been observed previously by several workers. The effect is particularly pronounced in Laue photographs (reproduced) of benzil. Further evidence is required to establish a correct interpretation of the effect. L. S. T.

Anomalous diffractions in the Hull–Debye–Scherrer spectrum of graphite. A. Taylor and D. Laidler (Nature, 1940, **146**, 130).—Extra lines have been repeatedly observed with many natural and artificial graphites. They are not confined to the electron-diffraction method (cf. A., 1936, 414, 1187). Cleaning the graphite until the ash content becomes zero does not affect the intensity of the lines, which are thus not due to impurities. Wet oxidation by heating with conc. $HNO_3 + H_2SO_4$ (2 : 3) for 24 hr., or with conc. H_2SO_4 for >400 hr., reduces the intensity to almost zero. The possible origin of the lines is discussed (cf. preceding abstract). L. S. T.

Fringes in the neighbourhood of the *K* discontinuity of *X*-rays. C. Kurylenko (J. Phys. Radium, 1940, [viii], **1**, 133—145).—Fringes near the *K* *X*-ray discontinuity of γ-Fe, Cu, Fe_3O_4, $FeCO_3$, FeF_2, $CuFeS_2$, $K_4Fe(CN)_6$, CuF_2, and $CuO + Cu_2O$ have been investigated at 20° and —180° and the influences of lamination and low temp. have been studied. At low temp. the *K* discontinuity of Fe and Cu is shifted slightly to longer λλ. The fringes of γ-Fe appear at 960—970° and the energy positions of "isolated min." agree with those of Cu at 20°. $K_4Fe(CN)_6$ decomposes on prolonged irradiation with *X*-rays. The presence of $Cu^IFe^{III}S_2$ and $Cu^{II}Fe^{II}S_2$ in chalcopyrite, suggested previously by Pauling, is partly confirmed. The *K* absorption spectrum of Fe_3O_4 indicates that two kinds of atoms of Fe are present. Theoretical interpretations of the data are advanced, particularly with respect to the magnitude of the fringe and the reflecting power of reticulate planes for electron waves. W. R. A.

Crystal structure of lithium. H. Perlitz and E. Aruja (Phil. Mag., 1940, [vii], **30**, 55—63).—Polycryst. Li containing ~0·25 at.-% Na, photographed with Cu *K* radiation, gives rotation–translation diffraction patterns of both Li (θ 18—80°) and Na. The solubility of Na in Li is therefore ≪0·25 at.-%. Li has a body-centred cubic lattice, the space-group being T^3—$I23$, T_d^3—$I\bar{4}3m$, T_h^5—$Im3$, O^5—$I43$, or O_h^9—$Im3m$, and the lattice const. at 20° 3·5017 ± 0·0002 A. L. J. J.

Reflexion of *X*-rays with change of frequency. I. Theoretical. II. Diamond. III. Sodium nitrate. (Sir) C. V. Raman and P. Nilakantan (Proc. Indian Acad. Sci., 1940, **11**, A, 379—388,

389—397, 398—408).—I. The scattering of radiation by crystals is discussed from the viewpoint of Brillouin's general theory; the general equations can be applied in the *X*-ray region to any type of coherent pulsation capable of giving periodic stratifications of the electron density of the crystal, provided that the λ of the stratifications is comparable with that of the incident *X*-radiation and is, therefore, of the same order of magnitude as the crystal spacings causing Bragg reflexions of unaltered frequency. By postulating a periodic pulsation of at. positions in all cells of the crystal lattice it is predicted that there will be superposed on each static structure-amplitude of the crystal a dynamic structure-amplitude having the same spacing and capable of giving a reflexion with changed frequency. Modified *X*-ray reflexions can be separated from unmodified reflexions by tilting the crystal away from the correct glancing angle for the *X*-ray λ used. The modified reflexion is a quantum, not a thermal, effect. Its analogies to the Compton effect are considered.

II. When a thin plate of diamond with faces parallel to one of the octahedral cleavages of the crystal is traversed by a pencil of *X*-rays normal to the faces, the pencil falls on three sets of [111] crystal planes at a glancing angle of 19° 28′, and the reflexions from these planes appear on the Laue diagram as three distinct spots forming an equilateral triangle. An interpretation is advanced. The effective lattice vibration is 1332 $cm.^{-1}$ The influence of temp. on the phenomenon is discussed.

III. The reflexions of an *X*-ray beam inclined (i) to the trigonal axis at angles of 56°, 50°, 44°, and 39°; (ii) to the (222) planes at angles of 18° and 22°; (iii) perpendicular to a cleavage face at temp. of 25°, 200°, 225°, and 275° are recorded and discussed.

W. R. A.

Short table of quantities used in computations for cubic space lattices. L. W. McKeehan (J. Chem. Physics, 1940, **8**, 567—568). W. R. A.

Glide elements of body-centred cubic crystals, with special reference to the effect of temperature. E. N. da C. Andrade and Y. S. Chow (Proc. Roy. Soc., 1940, **A**, **175**, 290—315).—Experiments on single crystals of Na show that the direction of glide is in all cases [111] but the glide plane changes from (112) to (110) to (123) as the temp. rises from —185° to 20°. In body-centred cubic metals the operative glide plane depends on the temp. The crit. shear stress of Na varies but little in the temp. range —185° to 20°. The spacing of the glide planes in Na, Fe, and Mo increases markedly with temp. Measurement of the asterisms on Laue photographs of strained crystals shows that the rotation of the crystallites is greatest at low temp. where the strain-hardening is greatest. G. D. P.

Fundamental relation between lattice constants and density. F. Foote and E. R. Jette (Physical Rev., 1940, [ii], **58**, 81—86).—Since lattice consts. have been based on Siegbahn's crystal λλ which are known to differ from true λλ, it is proposed to define a unit, the "crystal angstrom" (A_{cr}) as 10^3 X units, for use in crystal structure work, and to rewrite the fundamental density equation in the form $\rho = K(nM/V')$, where n = no. of atoms or mols. in the unit cell, M = at. or mol. wt., and V' = vol. of the unit cell in A_{cr}. Evaluated empirically from data on calcite, the const. K is $1{\cdot}650_{23} \pm 0{\cdot}00015$, and this val. must be used in calculating densities from lattice consts. if crystal λλ are used. Calc. vals. of ρ for Al, Mg, Ni, Cu, and Ag are given and discussed.

N. M. B.

Crystal structure of monoclinic α-Bi_2O_3. L. G. Sillén (Naturwiss., 1940, **28**, 206—207).—α-Bi_2O_3 has *a* 5·83, *b* 8·14, *c* 7·48 A., β 67·07°; 4 mols. in unit cell. The positions of atoms in the lattice have been calc. with the aid of a simplified Patterson analysis.

A. J. M.

Crystal chemical studies of the alums. I. Solid solutions of potassium aluminium and ammonium aluminium alum. H. P. Klug and L. Alexander (J. Amer. Chem. Soc., 1940, **62**, 1492—1493).—*X*-Ray investigations of the solid solutions of K and NH_4 alums indicate that the lattice consts. deviate slightly from Vegard's additivity law. At 25±0·1° the lattice const. a_0 is 12·133±0·001 A. for $K_2SO_4,Al_2(SO_4)_3,24H_2O$ and 12·214±0·001 A. for $(NH_4)_2SO_4,Al_2(SO_4)_3,24H_2O$. J. W. S.

Redetermination of the parameters in ammonium hydrogen fluoride. M. T. Rogers and L. Helmholz (J. Amer. Chem. Soc., 1940, **62**, 1533—1536).—From oscillation photographs of orthorhombic NH_4HF_2 crystals the unit translations have been revised to a_0 8·426, b_0 8·180, c_0 3·69 A. The assignation of the D_{2h}^7 space-group is confirmed. The four shortest N—F distances are all 2·80±0·025 A. and the F—F distances in the two non-equiv. HF_2' ions are 2·32±0·03 A. The last val. is slightly > in KHF_2, this being attributed to weakening of the bond by the two extra H bonds formed in NH_4HF_2. The fact that the N—F distance is > in NH_4F confirms that the H bond in NH_4HF_2 is weaker than in NH_4F.

J. W. S.

Crystal structure of potassium fluoroiodate, KIO_2F_2. L. Helmholz and M. T. Rogers (J. Amer. Chem. Soc., 1940, **62**, 1537—1542).—From *X*-ray investigations of the crystal structure of KIO_2F_2 it is shown that the IO_2F_2 ion comprises an I atom, forming linkings at ~100° with 2 O atoms, and, perpendicular to the plane of these three atoms, linkings to the two F. The interat. distances are I—O 1·93±0·05 and I—F 2·00±0·05 A. The influence of the unshared electron pair on the bond distance is discussed. J. W. S.

Lattice structure of monoclinic $FeSO_4,7H_2O$ (green vitriol, melanterite). I. Ness (Naturwiss., 1940, **28**, 78).—*X*-Ray analysis of monoclinic $FeSO_4,7H_2O$ gives *a* 15·33, *b* 6·50, *c* 20·08 A., β 104° 15′ 30″. Unit cell contains 8 mols. The space-group is probably C_{2h}^5. A. J. M.

Crystal structure of phosphorus pentabromide. H. M. Powell and D. Clark (Nature, 1940, **145**, 971).—PBr_5, orthorhombic, a_0 5·6, b_0 16·9, c_0 8·3 A., space-group *Pbcm*, has 4 mols. per unit cell. The structure contains tetrahedral $[PBr_4]^+$ groups located so that a plane of symmetry passes through each, and the fifth Br is present as Br′ removed from

the P at a distance approx. twice that of the four covalently-linked atoms. The cryst. form is entirely different from that of PCl_5 (cf. A., 1940, I, 150). L. S. T.

Crystal structure of Rochelle salt. C. A. BEEVERS and W. HUGHES (Nature, 1940, **146**, 96).—The unit cell is 11·93 × 14·30 × 6·17 A., $Z = 4$; space-group $P2_12_12$. Co-ordinates of the various atoms are recorded. The H_2O mols. are probably of the three- or four-bonded type; they co-ordinate the Na and K and assist in linking these to the tartrate mol., which has an extended C chain with the two identical halves of the mol. lying in two planes inclined at 60°. L. S. T.

Crystal structure of conjugated hydrocarbons at low temperatures. I. Butadiene. C. H. B. CLEWS (Trans. Faraday Soc., 1940, **36**, 749—752; cf. A., 1938, I, 235).—$(CH_2{:}CH)_2$ at −170° is tetragonal, with $a = b =$ 13·20 A., c 8·46 A.; there are probably 16 mols. in the unit cell, giving $\rho_{calc.} = 0·967$. F. J. G.

Patterson projection of the skeletons of the structure proposed for the insulin molecule. D. WRINCH (Nature, 1940, **145**, 1018).—The diagrams submitted by Riley and Fankuchen (A., 1939, I, 512) support, and do not disprove, the cyclol hypothesis. L. S. T.

Fabric theory of protein structure. D. WRINCH (Phil. Mag., 1940, [vii], **30**, 64—67).—A new class of at. fabric, having the composition appropriate for proteins, and capable of forming cage structures, is suggested as an alternative to the original cyclol structure. In the patterns suggested, some NH_2- and NH-acid residues function in the enol forms $\dot{:}C(OH)\cdot\dot{C}_aR\cdot NH\cdot$ and $\dot{:}C(OH)\cdot\dot{C}_a\cdot N\cdot$, rendering continuous fabrics possible by prototropic cyclisations and polymerisations of linear peptides. L. J. J.

Physical investigation of protein molecules. P. JORDAN (Naturwiss., 1940, **28**, 69—77).—A review. The determination of the mol. wt. of proteins by means of the ultracentrifuge, the analysis of the structure of pepsin, excelsin, and insulin by the Patterson–Harker X-ray method, the chain structure of protein mols., and the denaturation of proteins by heat and radiation are considered. A. J. M.

Intermicellar hole and tube system in fibre structure. H. MARK (J. Physical Chem., 1940, **44**, 764—788).—Modern theories of the structure of cellulose and related substances as revealed by X-ray analysis are discussed. It is shown that physical properties—tenacity, elasticity, etc.—are functionally related to the amount of cryst. material, whilst chemical properties—swelling, drying, ease of chemical reaction, etc.—are associated with the amorphous parts. Both of these properties are determined by the relative frequency and length of the micelles and consequently by the average chain length. The behaviour of a system depends (a) on the relative amounts of cryst. and amorphous fractions, (b) on the ratio between the average length of the main-valency chains and the average length of the cryst. regions, and (c) on the flexibility of the fringes and their sensitivity to swelling and chemical reactions. A bibliography of 118 references is appended. C. R. H.

Origin of deformation textures. C. S. BARRETT (Physical Rev., 1938, [ii], **53**, 925—926).—Single crystals of Fe deformed in compression do not seek a single final orientation as do single metal crystals in general. After compression, most Fe crystals consist of fragments possessing two orientations, with (111) and (100) axes, respectively, in the axis of compression. L. S. T.

Variation of intensity along an electron reflexion ring. K. R. DIXIT (Current Sci., 1940, **9**, 225—226).—Reflexion of electrons from a polycryst. surface gives semicircular ring patterns and reflected rays lie on a cone with incident beam as axis. The path traversed and the amount of absorption for electrons reflected in the plane of incidence are < for those moving along any other generator of the cone. On the assumption of an exponential law of absorption for X-rays, the intensities for various angles have been computed and compared with vals. observed using polished Ag etched to give rings. W. R. A.

Crystalline transitions and dielectric constant. H. VON R. JAFFE (Physical Rev., 1938, [ii], **53**, 917).—At a transition point from a pyroelectric to a non-pyroelectric crystal class, ϵ in the polar direction approaches infinity if the transition occurs without latent heat. The sharp max. known for ϵ, *e.g.*, for Rochelle salt and KBr, must be ascribed to changes in crystal symmetry. L. S. T.

Dark bands in spectra of double diffraction gratings. R. A. HOUSTOUN (Phil. Mag., 1940, [vii], **30**, 68—78).—The formation of dark bands in spectra formed by passage of light twice through both quartz-plate ultrasonic gratings and optical gratings is explained. The bands can be used for the determination of ultrasonic λ. L. J. J.

Optical and magnetic properties of magnetite suspensions. Surface magnetisation in ferromagnetic crystals. L. W. MCKEEHAN (Physical Rev., 1940, [ii], **57**, 1177—1178; cf. Heaps, A., 1940, I, 254).—A magneto-optic effect discovered by Grove in 1845 is suggested as helping to explain peculiarities of ferromagnetic colloid patterns on ferromagnetic crystal surfaces. N. M. B.

Optics of starch grains. A. FREY-WYSSLING (Naturwiss., 1940, **28**, 78—79).—The bearing of the mol. structure of starch on its optical properties is discussed. Recent chemical investigations indicate that the starch mol. is spiral, which would make the substance optically negative, whereas it is actually optically positive, indicating an extended mol. Investigations on starch grains show, however, that the double refraction is less of a characteristic double refraction than one due to strain. It cannot give information concerning the orientation of sub-microscopic structural elements in the starch grain, but would indicate the possible presence of radial tensions in the grain. A. J. M.

Optical activity, circular dichroism, and absorption of crystalline nickel sulphate. L. R. INGERSOLL, P. RUDNICK, F. G. SLACK, and N. UNDER-

WOOD (Physical Rev., 1940, [ii], **57**, 1145—1153; cf. A., 1938, I, 563).—Previous measurements of optical rotatory power (α) are extended to cover the range 0·25—2·2 μ., and circular dichroism and absorption measurements are made over the infra-red range. Marked anomalies in the rotatory dispersion curve appear at 0·69 and 1·16 μ., corresponding with absorption and circular dichroism max. at these $\lambda\lambda$. The theoretical relation between α and dichroism is verified exactly, particularly with regard to the 1·16-μ. band. N. M. B.

Calculation of transition energies of polymorphous molecular crystals. M. BRUCH-WILLSTÄTTER and H. SPONER (Physical Rev., 1938, [ii], **53**, 324).—The energies of transition at low temp. from an oscillatory motion of the mols. of the crystal to a rotational motion have been calc. for N_2, CO, HCl, and HI by using London's theory of van der Waals forces. N_2, CO, and HCl show transitions with a change in crystal structure, but HI preserves its lattice type during the transition. L. S. T.

Crystal habit variation in sodium fluoride. C. FRONDEL (Amer. Min., 1940, **25**, 338—356; cf. A., 1940, I, 199).—The effect of 143 inorg. and org. co-solutes, other than dyes, on the cryst. habit of NaF is described. Co-solutes that affect variation from the cubic habit fall into two groups: (i) those that contribute OH′ to the solution and change the habit to octahedral above a certain concn., and at still greater concns. produce a reversal of habit back to cubic, and (ii) those that react to form double salts with NaF. In (i) change is due to substitutional adsorption of OH′ for F′ in the surface of the growing crystal. In (ii) habit variation is related to structural coincidences between crystals of NaF and of the double salt, and marks an approach to a double salt phase boundary in the solute–co-solute system. Adsorption is not by substitution, but involves the formation of a two-dimensional, cryst., double salt phase in ordered apposition to the surface ions of the NaF crystals. Mechanisms of habit variation are discussed in relation to the views of Buckley (A., 1934, 1160) and Bunn (A., 1933, 1106). L. S. T.

Measurement at high frequencies of the diamagnetic Faraday effect in liquids. G. C. COMSTOCK (Physical Rev., 1938, [ii], **53**, 849).—Direct measurements of the Verdet consts. of CS_2, glycerol, $Pr^{\beta}OH$, and $C_5H_{11}{\cdot}OH$ for optical frequencies far removed from their absorption ranges have been made in the frequency range 1—1·7 $\times 10^7$ cycles per sec. These consts. are independent of the frequency of the field. L. S. T.

Polar moment of cellosolves. W. H. BYERS and A. A. BLESS (Physical Rev., 1938, [ii], **53**, 852; cf. A., 1939, I, 242).—The polar moments of $OH{\cdot}[CH_2]_2{\cdot}OMe$ and $OH{\cdot}[CH_2]_2{\cdot}OEt$ in C_6H_6 are $2{\cdot}05 \times 10^{-18}$ and $2{\cdot}13 \times 10^{-18}$ e.s.u., respectively. L. S. T.

Surface potential changes of thin films in the transformation liquid to solid. C. OCKRENT and W. H. BANKS (Nature, 1940, **145**, 861—862).—Polar materials, *e.g.*, stearic acid and cetyl palmitate, show abrupt changes in potential at the m.p. Paraffin wax shows no change. L. S. T.

Anomalous dispersion and absorption of electric waves in solutions of amino-acids and dipeptides. J. B. BATEMAN and G. POTAPENKO (Physical Rev., 1940, [ii], **57**, 1185).—Measurements of ϵ and absorption coeffs., their increment per mol., and the calc. relaxation times tabulated for glycine, α- and β-alanine, glycyl-glycine and -alanine, and alanylglycine for electric waves of $\lambda = 25{\cdot}5$ cm. ($\nu = 1{\cdot}18 \times 10^9$ cycles) indicate that the anomalous dispersion and absorption increase with increasing mol. size, the dielectric increment is independent of concn., and the absorption coeff. increment tends to increase with concn. Results are discussed theoretically. N. M. B.

Electron emission into dielectric liquids. W. R. LEPAGE and L. A. DUBRIDGE (Physical Rev., 1940, [ii], **58**, 61—66).—The current between polished Ni electrodes in pure PhMe was measured as a function of electric field for 0—250,000 v. per cm. and —15° to 70°. The Richardson lines are straight but show a small slope (0·05—0·4 e.v.) and a small val. of the const. A (10^{-9}—10^{-11} amp. per sq. cm. per degree). The log i–$E^{\frac{1}{2}}$ curve shows a slope $\sim$ twice the val. $e^{\frac{3}{2}}/D^{\frac{1}{2}}kT$ predicted by the simple Schottky theory, but in agreement (probably accidental) with the Baker–Boltz theory (cf. A., 1937, I, 208), which is shown to be open to serious objections. It is suggested that for the low potential barrier at the metal–dielectric interface a combination of thermionic and field currents would be expected, accounting qualitatively for the observed behaviour. N. M. B.

Influence of magnetisation on the Benedicks homogeneous thermoelectric effect. W. W. MO, Y. K. HSÜ, and W. BAND (Proc. Camb. Phil. Soc., 1940, **36**, 381—386).—Complete hysteresis loops of the Benedicks e.m.f. in Ni wire under magnetising fields up to 300 gauss have been mapped. The curves are resolved into (i) a normal component in agreement with the symmetrical Thomson e.m.f. hysteresis, (ii) an anomalous component explicable by skin magnetisation effects. L. J. J.

Magnetic properties of non-homogeneous systems. I. Experimental technique. L. F. BATES, C. J. W. BAKER, and R. MEAKIN. **II. Nickel amalgams. III. Ferromagnetic cobalt and nickel in mercury.** L. F. BATES and C. J. W. BAKER (Proc. Physical Soc., 1940, **52**, 425—435, 436—442, 443—451).—I. A new apparatus employs an electromagnet with one pole tip having a cylindrical surface and the other a plane face, so that each portion of an amalgam in a vertical tube suspended from a torsion balance is exposed to the same val. of the gradient of H^2 in the direction along which motion of the tube is possible, thus allowing measurements with amalgams which separate on keeping.

II. Magnetic susceptibility data for 0·01—2·68 wt.-% Ni amalgams are reported. Freshly prepared, previously unheated amalgams are diamagnetic, the Ni showing a paramagnetic mass-susceptibility approx. independent of temp. On heating to 225° the amalgam becomes ferromagnetic, and the ferromagnetism persists over cooling. Results are ex-

plained in terms of Néel's theory of the ferromagnetism of Ni.

III. The ferromagnetic properties of Co (0·00093—0·0159) and Ni (0·00544—0·03870 wt.-%) dissolved in Hg were measured by the Gouy method, using a container tube evacuated as in Part I. They behaved as if Co had a sp. magnetisation of 190 instead of 163·9 and Ni one of 45·5 instead of 57·6 c.g.s. units per g. Results are discussed with reference to a theory, due to Jaanus, of the magnetic behaviour of traces of dissolved ferromagnetics. N. M. B.

Magnetic properties of nickel and its alloys. N. Hori (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 412—423).—Using the Bloch model the magnetic susceptibility (χ) of Ni has been calc. taking account of the excitation of the $3d$ electrons to the $4s$ band at high temp. and, particularly for alloys of low Ni content, the $1/\chi$–T curve becomes concave to the T axis at high temp. χ decreases as other metals are added at const. temp. W. R. A.

Magnetic properties of uranium oxides. H. Haraldsen and R. Bakken (Naturwiss., 1940, **28**, 127).—UO_3 is weakly paramagnetic; $\chi_{mol.} = 157 \times 10^{-6}$, independent of temp. θ in the Curie–Weiss law $\chi(T - \theta) = k$ is -180 for UO_2 and -170 for U_3O_8. The magnetic moment μ is 2·92 for UO_2 and 1·39 for U_3O_8. The small val. for U_3O_8 points to the formula UO_3,U_2O_5 instead of the more usually accepted $2UO_3,UO_2$. A. J. M.

Magnetic study of the effect of bond angle distortion. D. P. Mellor and W. H. Lockwood (Nature, 1940, **145**, 862).—Ni bisethyl 3 : 3′ : 5 : 5′-tetramethylpyrromethene-4 : 4′-dicarboxylate is paramagnetic, and the Ni atom has a magnetic moment of 3·2 Bohr magnetons. It is concluded that the forcing of the Ni–N linkings out of their normal coplanar disposition alters their character; they change from co-valent to ionic. L. S. T.

Ultrasonic velocity in carbon dioxide and ethylene in the critical region. C. M. Herget (J. Chem. Physics, 1940, **8**, 537—542).—Ultrasonic velocities were measured while the gas was allowed to follow a p–v isothermal. The pressure ranges were: CO_2, 5 to 98; C_2H_4, 35 to 75 atm. and the temp. were: CO_2, 28·0°, 30·0°, 31·0°, 32·0°, 33·0°, 35·0°, and 38·0°; C_2H_4, 9·7°, 18·7°, and 23·0°. With increased pressure the velocity in each gas decreases to a sharp min. and then rises steeply. The min. are discussed. The ratio of sp. heats near the crit. point is briefly discussed. W. R. A.

Optical constants of liquid thallium. A. P. Friesen (Physical Rev., 1938, [ii], **53**, 678).—The vals. of n with λλ 5790 and 5461 A. for Tl melted in H_2 were 1·304 and 1·153, respectively: the reflecting powers were 76·35 and 75·78%, respectively. L. S. T.

Lorentz–Lorenz constant for paraffin oil between 30° and 115°. A. P. Friesen (Physical Rev., 1938, [ii], **53**, 688).—The val. obtained is 0·3211±0·0005. L. S. T.

Light scattering in normal human dentine. Calculation of absorption and scattering coefficients. R. S. Manly, J. F. Bonner, and H. C. Hodge (J. Physical Chem., 1940, **44**, 745—751).—The empirical relation $\log (I_0/I) = at^b$ (I_0 and I = intensities of original and transmitted light, a = absorption coeff., t = thickness in cm., b = const.) is satisfied by optical data for normal dentine. a and the scattering coeff. (x) are respectively 0·03 and 9·0. The large val. of x is due to the tubular structure of the dentine. In transparent dentine x is markedly decreased although a is unchanged. C. R. H.

Specific heats of some aliphatic acids and their ammonium salts, and the atomic heat of nitrogen. S. Satoh and T. Sogabe (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 429—436).—The sp. heats of $H_2C_2O_4$, succinic, pyrotartaric, and tartaric acids and their NH_4 salts have been determined. From the differences between the mol. heats of the NH_4 salts and the acid, vals. for the at. heat of N have been deduced as 1·8, 6·4 and 4·2. The val. determined from various nitrides is 3·5 (cf. A., 1939, I, 310). W. R. A.

Specific heats of some solid aromatic acids and their ammonium salts and the atomic heat of nitrogen. S. Satoh and T. Sogabe (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 576—583).—Mean sp. heats of benzoic, cinnamic, *o*- and *iso*-phthalic acids and their NH_4 salts have been measured. Derived vals. for the at. heat of N vary according as comparison is made between the neutral and acid NH_4 salts or between each of these salts and the corresponding acid, and also with the aliphatic or aromatic character of the acid radical. O. D. S.

Liquid state of the elements. W. Hume-Rothery (J. Physical Chem., 1940, **44**, 808—824).—Theoretical. An attempt is made to correlate the b.p. and liquid ranges of the elements with their electronic structure and with their position in the periodic table. C. R. H.

Normal m.p. and b.p. of iodine. J. D. Parent (J. Chem. Educ., 1940, **17**, 189).—When I is heated in a test-tube drawn out until the opening is $\not>$ a few mm. in diameter, fusion and boiling can be observed. L. S. T.

Thermodynamic properties of fluorochloromethanes and -ethanes. Heat capacity of the liquid and vapour of three fluorochloromethanes and trifluorotrichloroethane. A. F. Benning, R. C. McHarness, W. H. Markwood, jun., and W. J. Smith (Ind. Eng. Chem., 1940, **32**, 976—980).—Thermal data for $CHClF_2$, $CHCl_2F$, CCl_3F, and $CCl_2F{\cdot}CClF_2$ are recorded. C_v for the four compounds can be respectively represented by 10·44 + 0·0230θ; 11·47 + 0·0259θ; 15·55 + 0·0257θ; 25·60 + 0·0391θ, where θ = °c. C_p/C_v vals. obtained by sound velocity experiments agree with vals. calc. from experimental C_p vals. and the corresponding equations of state. C. R. H.

Isomerisation equilibrium of *n*-butane and *iso*butane and the third law of thermodynamics. G. H. Messerly, J. G. Aston, and R. M. Kennedy (J. Amer. Chem. Soc., 1940, **62**, 1630—1631).—Studies of the thermal properties of *n*- and *iso*-C_4H_{10} indicate that they have $S^0_{272\cdot66^\circ\,K.} = 72{\cdot}05 \pm 0{\cdot}2$ and

67·54±0·2 e.s.u., respectively. From these vals., together with heat capacity data, it is deduced that for the conversion of gaseous n-C_4H_{10} into gaseous *iso*-C_4H_{10} $\Delta S^{\circ}_{298\cdot1} = -3\cdot7 \pm 0\cdot3$ e.s.u., in accord with the vals. deduced from other data. J. W. S.

Steric inhibition of resonance. R. T. Arnold, G. Peirce, and R. A. Barnes (J. Amer. Chem. Soc., 1940, **62**, 1627—1628).—In accord with the view that the reduction in resonance by steric hindrance should increase the electron density at the NH_2-N atom, it is found that the basicity of 1 : 4-NMe_2·$C_{10}H_6$·NO_2 is $\gg$ that of 1 : 4-NH_2·$C_{10}H_6$·NO_2. In accord with this theory also, substitution of NMe_2 for NH_2 lowers the m.p. of p-NH_2·C_6Me_4·NO_2, and substitution of the H in the NH_2 of 1 : 4-NH_2·$C_{10}H_6$·NO_2 lowers its m.p., the effects following the order NHMe < NHEt < NH·CH_2Ph < NMe_2 < NEt_2. J. W. S.

α- and β-Monopalmitin; heats of combustion and specific heats at 25°. T. H. Clarke and G. Stegeman (J. Amer. Chem. Soc., 1940, **62**, 1815—1817).—The heats of combustion of α- and β-monopalmitin at 1 atm. and 25° are respectively 2778·78±0·36 and 2788·30±0·67 kg.-cal. per g.-mol. This gives a heat of isomerisation from β to α of −9·52 kg.-cal per g.-mol. For α- and β- respectively ρ = 1·04 and 1·03, and the sp. heat =0·436 and 0·439, at 25°. F. J. G.

Explanation of a rule for critical temperatures. J. Corner (Trans. Faraday Soc., 1940, **36**, 781—784).—The theory of liquids developed by Lennard-Jones and Devonshire (A., 1939, I, 248, 358) explains the form of Watson's rule for crit. temp. (A., 1931, 675) and of certain other relationships involving the crit. temp. F. J. G.

Transitions in nickel nitrate hexammoniate. E. A. Long and F. C. Toettcher (J. Chem. Physics, 1940, **8**, 504).—The C_p–temp. curve shows two points of high energy absorption at 85° and 243° K., the former being of much smaller magnitude. The transition at 243° K. can be supercooled to liquid air temp. and maintained indefinitely at that temp. The height of the max. at 243° K. cannot be determined, but, from the excess heat effect, the corresponding entropy is 7·65±0·5 g.-cal. per degree per mol., a val. which would suggest that both NH_3 and NO_3 groups are performing rotational oscillations. W. R. A.

B.p. relationships among aliphatic hydrocarbons. G. Egloff, J. Sherman, and R. B. Dull (J. Physical Chem., 1940, **44**, 730—745).—The b.p. of 31 homologous series of aliphatic hydrocarbons involving 143 compounds can be satisfactorily expressed by $T = 745\cdot42 \log (n + 4\cdot4) + k$, where n is the no. of C atoms in the mol. and k has a const. val. for each series. C. R. H.

Vapour pressures of nickel and of nickel oxide. H. L. Johnston and A. L. Marshall (J. Amer. Chem. Soc., 1940, **62**, 1382—1390).—The rate of evaporation of solid Ni at 1300—1600° K. has been measured and the v.p. is deduced. From measurements of the rates of loss of Ni and O from Ni rings coated with a thin film of NiO the v.p. of NiO at 1440—1566° has been determined. Within the temp. range used decomp. of NiO had no effect on the results. The heats of sublimation of Ni and NiO at 0° K. are 101·141±150 and 117·055±1000 g.-cal. per g.-mol., respectively. Evaporation of free Ni is little retarded by the presence of NiO coatings 2—9 μ. thick. Recent data on the heat capacity of Ni are reviewed and vals. of various thermodynamic functions of Ni and NiO are tabulated. J. W. S.

Vapour pressures of trimethylphosphine, trimethylarsine, and trimethylstibine. E. J. Rosenbaum and C. R. Sandberg (J. Amer. Chem. Soc., 1940, **62**, 1622—1623).—The v.p. of PMe_3, $AsMe_3$, and $SbMe_3$ have been determined at −25° to 25°. The b.p. are 37·8°. 49·5°, and 78·5°, respectively, whilst the calc. heats of vaporisation are 6943, 6660, and 7760 g.-cal. per mol., respectively. The mol. wts., determined by the v.d. method, indicate that the mols. are not associated. J. W. S.

Entropy of dimethyl sulphide from low-temperature calorimetric measurements. Restricted rotation of the methyl groups. D. W. Osborne, R. N. Doescher, and D. M. Yost (J. Chem. Physics, 1940, **8**, 506).—For Me_2S C_p has been measured from 13·4° to 294° K. The heats of fusion and vaporisation are 1908·4 and 6696 g.-cal. per mol., respectively. The v.p. has been determined from 250° to 293° K. The entropy at 291·06° K. and 365·5 mm. is 69·35 from calorimetric and from spectroscopic data The potential barrier restricting free rotation of the Me groups is ~2000 g.-cal. per mol. W. R. A.

Entropy of vaporisation and restricted molecular rotation in liquids. R. S. Halford (J. Chem. Physics, 1940, **8**, 496—499).—Deviations among entropies of vaporisation of liquids are discussed from the viewpoint of restricted mol. rotation, assuming an arbitrary measure of the amount of rotation; they exhibit remarkable regularity. W. R. A.

Effect of pressure on enthalpy of benzene. E. R. Gilliland and R. V. Lukes (Ind. Eng. Chem., 1940, **32**, 957—962).—A modified isothermal-expansion method has been used to obtain data on the enthalpy of C_6H_6 in the crit. region, and the enthalpy changes are recorded in tabular and graphical form. Comment is made on the marked similarity between the curves and similar ones for n-C_7H_{16}, especially near the crit. point. C. R. H.

Internal friction at high temperatures. A. H. Barnes and C. Zener (Physical Rev., 1940, [ii], **58**, 87).—Investigations with Zn of various grain sizes show that the apparently new type of internal friction at high temp. has a heat of activation of 5200 g.-cal. per atom. For the specimen of largest grain the contribution of the intercryst. thermal currents is appreciable. The temp.-dependent part of the internal friction varies inversely with grain size, and hence its source lies on the boundaries rather than in the interior of the grains. N. M. B.

Diffusion of helium through glasses.—See B., 1940, 604.

Miscibility of carbon dioxide and water under high pressure. D. L. Katz (J. Amer. Chem. Soc.,

1940, **62**, 1629—1630).—The statement of Wiebe and Gaddy (A., 1940, I, 251) that the compositions of the gas and liquid phases in the system CO_2–H_2O at 12° and 600 atm. are identical is apparently contradictory to the statement that the mutual solubility of H_2O and CO_2 as a liquid–liquid system is affected only to a slight extent by pressure (A., 1939, I, 194). This may be explained, however, on the view that at 12° CO_2 is relatively near its crit. temp. and is more compressible than H_2O, so that whereas at low pressure the H_2O phase is the denser, at 200 atm. and 10° or at 500 atm. and 20° the fluids reach equal density and may form a relatively uniform suspension. J. W. S.

Kinetic explanation of osmotic pressure. W. V. Metcalf (Kolloid-Z., 1940, **90**, 11—16).—Theories of osmotic pressure are reviewed, and their inadequacies are pointed out. A kinetic theory is developed on the assumption that in a liquid in equilibrium the sum of the thermal (kinetic) and diffusion pressures is equal to the sum of the external, cohesive, and hydrostatic pressures. It is suggested that in osmosis the force causing the solvent to pass through the membrane into the solution is the difference between the diffusion pressures of the solvent on the two sides of the membrane, whilst the force maintaining the increase in hydrostatic pressure is the diffusion pressure of the solute. J. W. S.

Duhem–Margules equation and Raoult's law. C. R. Bury (Trans. Faraday Soc., 1940, **36**, 795—797).—The customary thermodynamical treatment of the Duhem–Margules equation and of Raoult's law is inexact. Modified expressions are derived for Raoult's law, applicable respectively to cases where an inert gas is present, as in measurements of v.p. by the dynamic method, and to mixtures of liquids the v.p. of which are not all equal. F. L. U.

Solvent effect in dipole moment measurement. II. Resolution of the solvent effect into its contributory factors. F. R. Goss (J.C.S., 1940, 752—758).—The equation previously given (A., 1938, I, 136) is analysed, and effects of anisotropy of the electric field, of the reaction field, and of permanent dipoles are identified. Relations are given whereby observed polarisations in the liquid state may be corr. F. J. G.

Relation between coefficient of thermal expansion and structure of solutions. R. Wright (J.C.S., 1940, 870—873).—The coeffs. of thermal expansion (α) of aq. solutions of 18 inorg. salts and 6 org. compounds and of PhMe solutions of 8 org. compounds have been determined between 25° and 78°. With increasing concn. of solute α for aq. salt solutions increases to a val. which remains const. over a considerable range of concn. On the other hand, α for aq. solutions of org. compounds increases continually with concn. The behaviour of PhMe solutions depends on the polar or non-polar nature of the solute. In general, α remains unchanged over a considerable range of concn. where there is a large difference between the polarities of solvent and solute, but where the polarities are similar α varies continuously with concn. The constancy of α in the former case is explained on the assumption that the mols. of the polar solute are linked to form a continuous mesh extending throughout the solution, the system being comparable with a porous substance with free liquid inside the pores. This liquid would not materially affect α of the porous substance. C. R. H.

Electrolytic growth of ionic crystals. A. R. Ubbelohde (Trans. Faraday Soc., 1940, **36**, 863—867).—When pure Cu electrodes are immersed in a supersaturated solution of $CuSO_4$ (100 g. of $CuSO_4,5H_2O$ in 150 g. of H_2O at 20°), the passage of a small current (~5 ma.) causes the deposition of crystals on the anode. A similar effect is obtained with $NiSO_4$ on a Ni anode, and $MgSO_4$ on a Mg (but not on a Pt) anode. The phenomenon is discussed. F. L. U.

Vapour pressures of salt solutions. M. F. Bechtold and R. F. Newton (J. Amer. Chem. Soc., 1940, **62**, 1390—1393).—An automatically controlled apparatus for the exact measurement of the v.p. of solutions by the dynamic method is described. Measurements on 0·01—1·6M. aq. $BaCl_2$ shows that the activity of H_2O in these solutions changes only slightly with temp. The results are in good agreement with e.m.f. data. Results for 0·3—7M-$CaCl_2$ are also recorded. J. W. S.

Titanium sulphate solutions. Refractive index and viscosity measurements. A. W. Hixson and J. D. Stetkewicz (Ind. Eng. Chem., 1940, **32**, 1009—1015).—The dispersion, n, and η of solutions of TiO_2 in H_2SO_4 are tabulated. Concns. range from 0·5 to 26% of TiO_2 and SO_3/TiO_2 ratios from 1·001 to 3·004. The application of n to the rapid investigation of hydrolysis is illustrated. C. R. H.

Gel water in pure salt crystal systems and their hydrolytic decomposition on heating. N. Kolarow (Kolloid-Z., 1940, **90**, 28—32; cf. A., 1938, I, 398).—The loss of H_2O by NaCl and KCl crystals on heating at 150°, 230°, and 400°, and its re-absorption after cooling to room temp., have been investigated. The amount of H_2O held by the crystals is decreased by increasing their fineness of division or by preliminary heating at 80° during 45 days, which also causes a diminution in their vol. Colorimetric examination of the heated material with Me-red and titration with 0·0001N-HCl shows that hydrolysis of the halide occurs. This hydrolysis is decreased by ageing at 80° and is the more pronounced the higher is the temp. of heating and the more rapid the rate of heating. The results are discussed in the light of Balarev's gel theory (A., 1935, 447). J. W. S.

Carbamide. II. Vapour pressures of saturated solutions. W. Sakai (J. Soc. Chem. Ind. Japan, 1940, **43**, 131B).—The v.p. (in mm.) of saturated aq. solutions of $Co(NH_2)_2$ are given by the equations $\log p = -2106{\cdot}05(1/T) + 8{\cdot}3197$ (18—30°) and $\log p = -2104{\cdot}05(1/T) + 8{\cdot}0130$ (20—50°). The solutions do not obey Raoult's law. The reason for the discrepancy is neither association nor dissociation of $CO(NH_2)_2$ mols., and it is concluded that the solutions are not ideal. W. A. R.

Mixed crystals in the system FeO–MnO. V. Montoro (Gazzetta, 1940, **70**, 150—153).—*X*-Ray

measurements confirm the formation of a continuous series of cubic mixed crystals between FeO and MnO. The pure components FeO and MnO have a 4·295 and 4·438 A., respectively, and the mixtures obey Vegard's law. O. J. W.

Miscibility between the sesquioxides of iron and manganese. V. MONTORO (Gazzetta, 1940, **70**, 145—149).—*X*-Ray measurements show that Fe_2O_3 forms mixed crystals with Mn_2O_3 up to a mol. ratio of 1 : 1. These mixtures are isomorphous with and have the same lattice dimensions as Mn_2O_3. With mixtures containing >50 mol.-% of Fe_2O_3 the excess of Fe_2O_3 separates out free from Mn_2O_3. O. J. W.

Binary alloy system silver–tellurium. V. KOERN (Acta Comm. Univ. Tartu., 1940, **35**, 4—45; cf. A., 1939, I, 517).—A fuller account is given of work, some of the results of which have already been published. The eutectic of Ag with β-Ag_2Te is at 860°, Te 12 at.-% and that between α-$Ag_{12}Te_7$ and Te at 348°, Te 64·2 at.-%. Ag dissolves <0·5% of Te. Ag_2Te melts at 958° and the α–β change occurs at 165°. $Ag_{12}Te_7$ is formed by a peritectic reaction at 443° and the β-form is converted into the α at 408°. A. R. P.

Beryllium alloys. III. System beryllium–aluminium. L. LOSANA (Alluminio, 1940, **9**, 8—13; cf. B., 1939, 950).—The f.p. diagram shows that there is a eutectic at 644° with Be 1·1%. The mutual solubility of the two components in the solid state is greatly influenced by impurities. In the liquid state the two metals are completely miscible. O. J. W.

Optical constants and intermetallic compounds. A. P. FRIESEN (Physical Rev., 1938, [ii], **53**, 688—689).—The optical consts. of 12 liquid Tl–Bi alloys (0—30 at.-% of Bi) have been determined. Changes in the optical consts. near Bi 25 at.-% indicate compound formation. L. S. T.

Effect of pressure on the Curie point of iron–nickel alloys. J. C. SLATER (Physical Rev., 1940, [ii], **58**, 54—56).—Clapeyron's equation gives ~0·00005° per atm. for the rise of the Curie point of Ni with pressure, and this for Fe–Ni alloys would decrease as more Fe is added, becoming zero at ~70% Ni; for alloys containing more Fe the Curie point would fall with pressure. Hence it is unlikely that pressures in the Fe–Ni core of the earth would raise the Curie point enough to render the material ferromagnetic at the temp. therein, and improbable that the magnetism of the earth can be explained ferromagnetically. N. M. B.

Final solubility of *d*-galactose in water. S. P. GOULD (J. Dairy Sci., 1940, **23**, 227).—Mean vals. of 32·09 g. per 100 g. of solution and 47·25 g. per 100 g. of H_2O at 25° were found. J. G. D.

Diffusion in palladium. R. M. BARRER (Nature, 1940, **145**, 898).—Electrolysis of aq. NaOH at high c.d. with a Pd tube as cathode shows that in its most active state the Pd exhibits a rate of permeation for H_2 independent of c.d.; in the next most active state the curve permeation rate–(c.d.)$^{\frac{1}{2}}$ is parabolic, and with successive stages of deactivation, the curve approaches linearity. The results give evidence of changes in the relative velocities of phase boundary reactions and of diffusion with time, and support the theory discussed previously (A., 1939, I, 560). L. S. T.

Theory of the van der Waals adsorption of gases. S. BRUNAUER, L. S. DEMING, W. E. DEMING, and E. TELLER (J. Amer. Chem. Soc., 1940, **62**, 1723—1732).—Observed adsorption isotherms are of five different types. Three of these may be represented as special cases by the equation previously given (A., 1938, I, 190). An extended equation is now given which allows for the cases (i) that the heat of adsorption of the first layer is < the heat of liquefaction; (ii) that in a completely filled capillary the heat of adsorption of the last layer is < the heat of liquefaction. All five types of isotherm are now accounted for. F. J. G.

Theoretical isotherms for adsorption on a square lattice. L. TONKS (J. Chem. Physics, 1940, **8**, 477—489).—Theoretical. W. R. A.

Mixed adsorption.—See B., 1940, 577.

Swelling of wood charcoal. Experiments with a new silica extensometer. N. FAKHOURY and M. WAHBA (Nature, 1940, **146**, 63—64).—A SiO_2 extensometer for measuring the linear expansion of wood-C is described, and its advantages over the metal form described previously (A., 1931, 160) are discussed. Data for the linear expansion of three specimens of wood-C on the adsorption of MeOH are recorded and discussed. L. S. T.

Chemisorption of carbon dioxide by reduced iron. IV. Kinetics of chemisorption. K. KAWAKITA (Rev. Phys. Chem. Japan, 1940, **14**, 1—10).—If the velocity of adsorption of CO_2 on reduced Fe is assumed to be so high as to be negligible, the chemisorption of CO_2 can be shown to be similar to a heterogeneous catalytic reaction, the mathematical analysis of the latter type of reaction being applicable to the former. On the surface of the reduced Fe there exist active centres of two different characters for the reactions $Fe + (CO_2)_{ads.} \rightarrow Fe_xO_y + (CO)_{ads.}$ and $2(CO)_{ads.} \rightarrow C + (CO_2)_{ads.}$. The apparent heat of activation of chemisorption is 37 kg.-cal. per g.-mol. C. R. H.

Chemisorption of gases on iron synthetic ammonia catalysts. S. BRUNAUER and P. H. EMMETT (J. Amer. Chem. Soc., 1940, **62**, 1732—1746).—The chemisorption of a no. of gases (O_2, CO, N_2, CO_2, and H_2) at widely differing temp. on unpromoted, singly promoted (Al_2O_3), and doubly promoted (Al_2O_3 and K_2O) Fe synthetic NH_3 catalysts has been investigated. From a comparison of the results for the different gases, and from a study of the inhibiting effects of a layer of one gas on the adsorption of others, the following conclusions are reached. The Fe surface is heterogeneous, probably owing to the presence of different crystal faces, and the promoters are strongly conc. on the surface, the K_2O mols. being so distributed that almost every one has an Fe atom as neighbour. The CO_2 is adsorbed on the K_2O mols., the other gases on the Fe atoms. CO and CO_2 are adsorbed as mols., N_2 and H_2 as atoms, and O_2 probably as ions. The CO and CO_2

mols. remain entirely on the surface, the N and H atoms can probably migrate to Fe atoms situated underneath promoter mols., whilst the O ions penetrate several layers below the surface. There is evidence that Al_2O_3 catalyses, and K_2O inhibits, the formation of NH or NH_2 complexes from H_2 and chemisorbed N. F. J. G.

Microtome measurements of the adsorption of hydrocinnamic acid in the surface of its aqueous solutions. J. W. McBain, T. F. Ford, and G. F. Mills (J. Amer. Chem. Soc., 1940, **62**, 1319—1324).—Even after efficient stirring, the adsorption of $Ph\cdot[CH_2]_2\cdot CO_2H$ in the surface of its aq. solution, as determined by the microtome method (A., 1932, 331), is complete only after several hr. The measured adsorption is slightly > that calc. by the Gibbs equation from the surface tension of solutions of comparable age. J. W. S.

Adsorption of potential-determining ions. III. Adsorption of acids, neutral salts, and bases on highly activated carbon in the absence and presence of hydrogen or oxygen. A. Kellermann and E. Lange (Kolloid-Z., 1940, **90**, 89—104; cf. A., 1937, I, 612).—A review of recent investigations of the adsorption of electrolytes on platinised and unplatinised active C. J. W. S.

Change with time of surface tensions of solutions of sodium cetyl sulphate and sodium lauryl sulphate. G. C. Nutting, F. A. Long, and W. D. Harkins (J. Amer. Chem. Soc., 1940, **62**, 1496—1504).—The change with time of the γ of solutions of Na cetyl sulphate (I) and of Na lauryl sulphate (II) has been studied at 40° and for the concn. ranges 10^{-5}—10^{-3}N. and 5×10^{-4}—5×10^{-2}N., respectively. In solutions of (I) of concn. $<6 \times 10^{-4}$N. a rapid initial fall in γ is followed by a slow fall, which is linear with time and equal for all solutions. At concns. $>6 \times 10^{-4}$N. the initial fall is smaller and γ attains a const. val. of ~35 dynes per cm. Electrolytes hasten the attainment of const. vals. of γ at ~30 dynes per cm., their relative efficiencies increasing rapidly with increasing valency of the cation. In solutions of (II) the initial fall in γ is less marked, and γ passes through a min., after which a slow rise is observed. Electrolytes hasten the attainment of a const. γ of 25—30 dynes per cm., their order of efficiency being the same as for (I). The slow fall is attributed principally to the potential barrier set up against alkyl sulphate ions diffusing into the surface by ions already present in the surface film, whilst the sudden change in the time effect at a definite concn. is correlated with the appearance of micelles in the bulk of the solution, the effect of electrolytes being related to the crit. concn. for micelle formation. The apparent increase in the γ of soap solutions with increasing p_H is attributed to slow accumulation of fatty acid ions in the surface films at high p_H and rapid accumulation of fatty acid mols. by diffusion at low p_H. J. W. S.

Spreading of volatile organic liquids on water in the presence of unimolecular films. E. R. Washburn and C. P. Keim (J. Amer. Chem. Soc., 1940, **62**, 1747—1749).—A drop of a liquid like C_6H_6, when added to a H_2O surface on which there is a unimol. film, will spread, pushing back the film, if this is not too much compressed, but at a certain degree of film compression this is prevented, and the drop does not spread. In this way the spreading pressure may be measured, and data are given for a no. of org. liquids. The spreading pressures are independent of the nature of the unimol. film employed, and, over the range 20—25°, of temp. F. J. G.

Experimental detection of adsorbed soap films. R. Brill and F. Rieder (Angew. Chem., 1940, **53**, 100—103).—Adsorbed soap films on thin celluloid sheet can be detected by electron-diffraction measurements. It is shown that the adsorption involves mols. and not micelles and that the adsorbed mols. are perpendicular to the surface and form two-dimensional hexagonal crystals. When adsorbed from solutions of low concn. the films are probably unimol., but when formed from solutions of concn. >0·1% the films are >1 mol. thick. The adsorbed films are easily washed away excepting when they have been allowed to age for several days or when the adsorption has occurred at ~80°. J. W. S.

Measurements of pressures due to monolayers at oil-water interfaces. F. A. Askew and J. F. Danielli (Trans. Faraday Soc., 1940, **36**, 785—794).—The Langmuir-Adams surface balance has been adapted for use in an oil–H_2O interface, and pressure–area curves for monolayers of proteins and other substances at the PhBr–H_2O interface have been obtained. The areas per mol. are > those found at the air–H_2O interface, and this is attributed to the solvent action of the PhBr breaking down adhesions between non-polar parts of the surface mols. F. J. G.

Monolayers on solids. J. K. Roberts (J.C.S., 1940, 773—775).—Discussion and criticism of certain statements made by Langmuir (A., 1940, I, 292). F. J. G.

Effect of lyotropic anions on cation permeability.—See A., 1940, III, 684.

Scientific and technical importance of aerosols. F. Müller (Kolloid-Z., 1940, **90**, 1—10).—A review. The methods of formation of aërosols and the means for investigating their properties are summarised. J. W. S.

Study of metallic oxide smokes with the universal electron microscope. M. von Ardenne and D. Beischer (Z. Elektrochem., 1940, **46**, 270—277).—Metallic oxide smokes have been photographed with an electron microscope capable of resolving 30 A. F. J. G.

Effect of potassium salts on electrophoretic mobility of cetyl acetate emulsions, and on interfacial tension between cetyl acetate and water. W. Dickinson (Trans. Faraday Soc., 1940, **36**, 839—846).—Mobility (u)–concn. (c) curves for emulsified droplets of $C_{16}H_{33}\cdot OAc$ in 0—0·1N-KCl are of the normal type, showing a slight max. at ~0·0006N. and thereafter falling continuously. KI gives a very pronounced max., and with KCNS u increases over the whole range. Corresponding measurements of the interfacial tension (γ) show that

γ increases continuously with c for KCl, and decreases continuously with both KI and KCNS over the range 0—1N. KI has a greater effect than KCNS at low and a smaller effect at higher concns. Both sets of results can be accounted for by a positive adsorption of I′ and CNS′ on the droplets. F. L. U.

Hydrodynamical theory of the viscosity of suspensions. E. GUTH and O. GOLD (Physical Rev., 1938, [ii], **53**, 322).—For solutions of high-mol. substances with spherical shape, *e.g.*, rubber latex and protein solutions, and the change of η of lubricating oils by addition of small quantities of higher mol. compounds, $\eta = \eta_0(1—2{\cdot}5v/V—14{\cdot}1v^2/V^2)$, where η is the viscosity of the solvent, η_0 that of the suspension, v the total vol. of the suspended particles, and V the vol. of the suspension. L. S. T.

Theory of viscosity of suspensions of ellipsoidal particles. E. GUTH (Physical Rev., 1938, [ii], **53**, 926).—An expression for the η of suspensions is derived from an extension of Einstein's hydrodynamical theory for suspensions of spherical particles to those of ellipsoidal particles. L. S. T.

Viscosity of suspensions and the Einstein equation. E. W. J. MARDLES (Nature, 1940, **145**, 970).—The ratio η/η_0, where η is the viscosity of the suspension and η_0 that of the dispersion medium, depends partly on temp. Curves showing the variation of log $(\eta/\eta_0 - 1)$ with log. (% vol. occupied by the dispersed solid) for powdered SiO_2 in various media are reproduced and discussed. L. S. T.

Separation and fractionation of colloidal systems.—See B., 1940, 576.

Fine particle suspensions in organic liquids. C. R. BLOOMQUIST and R. S. SHUTT (Ind. Eng. Chem., 1940, **32**, 827—831).—The sedimentation vol. (S.V.) of 5—15-μ. glass spheres (prepared by introducing finely powdered Pyrex glass into the air-line of a blow-lamp) is a min. in H_2O and H_2O-miscible org. liquids. In liquids in which H_2O is slightly sol. the final vols. are small if the liquids are pure and dry, or can be made to approach the min. as dryness is increased; S.V. is large in liquids saturated with H_2O. The increase in S.V. is produced by flocculation due to the presence of H_2O and is dependent on the interfacial tension between the org. liquid and H_2O. Dipole moments and dielectric consts. influence S.V. only insofar as they affect interfacial tension. I. C. R.

Binding of water by colloids.—See A., 1940, III, 685.

Influence of temperature on the formation of platinum carbonyl sol. I. SANO (Bull. Chem. Soc. Japan, 1940, **15**, 106—113).—Details of the effects of temp. and concn. on the formation of red, brown, and black sols from H_2PtCl_6 and CO (cf. A., 1934, 1170) are given. Extinction curves for the red sols have a max. at ~540 mμ., those for the others fall smoothly with increasing λ. The formation of the red sols is facilitated by low temp. and low concn. F. J. G.

Dialysis of platinum carbonyl sol. I. SANO (Bull. Chem. Soc. Japan, 1940, **15**, 207—208).—Pt carbonyl sols (cf. A., 1934, 1170) remain unchanged in constitution when dialysed in an atm. of CO. The dialysed sols contain no Cl, and are converted into Pt by the action of air or heat. F. L. U.

Formation of aggregates and structures in dilute solutions of hydrogen bentonites. J. N. MUKHERJEE and N. C. SEN GUPTA (Nature, 1940, **145**, 971—972). L. S. T.

Micelle formation in aqueous solutions of digitonin. E. L. SMITH and E. G. PICKELS (Proc. Nat. Acad. Sci., 1940, **26**, 272—277).—Ultracentrifuge measurements at 160,000 g show formation of large (≮60 mol.) micelles of const. size in aq. digitonin solutions. The average sedimentation const. of the micelles is $5{\cdot}88 \times 10^{-13}$ cm. per dyne per sec. L. J. J.

Disintegration of starch paste by irradiation with ultrasonic waves. S. ONO (Rev. Phys. Chem. Japan, 1940, **14**, 25—41).—The disintegration of potato and wheat starch by ultrasonic waves (470 and 800 kc. per sec.) has been studied by observing changes in sp. vol. (ϕ) and microscopic structure of the particles. The disintegrating effect at the higher frequency is > at the lower, and the rate of disintegration for potato is > for wheat starch. The reduction in ϕ is comparable with that caused by heating to 150°. The max. effect is obtained when the external air pressure is ~1 atm. The influence ot dissolved gases in the paste is slight. Disintegration is caused by mechanical action due to the pulsation of bubbles and by hydrolysis brought about by rise in temp. caused by adiabatic compression of bubbles. Some depolymerisation accompanied by oxidation may also occur. Pure mechanical (frictional) forces caused by vibration of medium sized particles and kinetic energy changes in paste granules are considered to have no effect in the early stages of disintegration. 31 photomicrographs are included. C. R. H.

Behaviour of starch solutions at extremely high rates of shear. W. SECK and G. FISCHER (Kolloid-Z., 1940, **90**, 51—58).—After treatment in a colloid mill at 70°, the η of solutions of various types of starches (prepared by heating a suspension of the starch in H_2O at 95°) is decreased by 56—98%. The effect is the greatest for those forms of starch in which the swollen granule remains stable. The mechanical treatment tends to equalise the η of various types of starch, the val. tending towards the natural η of starch, uninfluenced by cell-wall and swelling processes. J. W. S.

Structural viscosity in various kinds of potato starch products. H. GEINITZ (Kolloid-Z., 1940, **90**, 58—65).—The times of flow through a capillary tube of 0·2% solutions of various types of starch and starch products have been studied at 20° and with various applied pressures. Deviation from the Hagen–Poiseuille law is greatest for untreated starch and less for chemically treated starch. Solutions of sol. starch obey the law, and their η does not change with age, but with other forms the η decreases with age, finally reaching a steady val. J. W. S.

Establishment and application of rules for interaction between high-molecular solutes and

organic solvents. W. Coltof (J. Oil & Col. Chem. Assoc., 1940, **23**, 176—209).—The theory of dissolution phenomena previously suggested (B., 1937, 1369) is applied, with the aid of triangular diagrams, to many three-component liquid mixtures for the dissolution of cellulose derivatives. As the solvent activity of a liquid depends to some extent on its micellar peculiarities it cannot be predicted from the physical consts., although for some, *e.g.*, dipole moments, restricted parallelism may occur. The use of solvent "maps" based on γ–μ^2/ϵ relations is also criticised. S. M.

Sedimentation and diffusion measurements with pectic materials. S. Säverborn (Kolloid-Z., 1940, **90**, 41—50).—The sedimentation const., diffusion const., and partial sp. vol. of solute, and the η of various solutions of natural, H_2O-extracted, acid-hydrolysed, and nitrated pectin (from apples, currants, and lemon pith) have been determined. The mean mol. wt. of the natural pectin varies from 33,000 to 271,000, according to its origin, but dynamic double refringence measurements indicate that the material is not of uniform particle size; this is attained after hydrolysis with 0·05N-H_2SO_4. Nitration of pectin yields a product which resembles and has the same sedimentation const. in solution as cellulose nitrate. J. W. S.

Thermoelastics and structure of rubber. F. E. Dart and E. Guth (Physical Rev., 1938, [ii], **53**, 327).—It is concluded that there are samples of rubber for which an equation of state of the van der Waals type holds good. L. S. T.

Isoelectric point of gelatin. E. C. E. Hunter and A. J. Turner (Trans. Faraday Soc., 1940, **36**, 835—839).—Determination of the isoelectric point of acid-treated (I) and limed (II) gelatins by several different methods gives for (I) p_H 6—7 and for (II) the normal range p_H 4·8—5·0. F. L. U.

Dielectric properties of the system gelatin-water. II. H. Fricke and E. Parker (J. Physical Chem., 1940, **44**, 716—726).—The dielectric const. (ϵ) of dried gelatin (I) is nearly independent of frequency ($\epsilon = 2{\cdot}68$ at 512 kc.). ϵ for (I)–H_2O systems containing a low proportion of H_2O depends on the temp. to which the (I) is heated in preparing the system. Temporary exposure to a high temp. increases the polarisability of the system but prolonged heating decreases polarisability. These internal changes are reversible if the exposure $\not> \sim 70°$. The data support views previously expressed (cf. A., 1939, I, 417). C. R. H.

Existence of a vitreous state in gelatin gels. B. J. Luyet (Physical Rev., 1938, [ii], **53**, 323).—Gelatin gels of concns. from 10 to 60% can be brought to temp. at which their η is of the order observed in solids, but their structure is not cryst., by immersion in liquid air in thin layers. They remain transparent and isotropic, but are hard and brittle. When warmed slowly they crystallise. L. S. T.

Viscosity–fluidity relations of proteins. H. P. Treffers (J. Amer. Chem. Soc., 1940, **62**, 1405—1409).—For a large no. of proteins and over wide ranges of concn. the fluidity of a protein solution varies linearly with its concn. The fluidity is additive for mixtures of rabbit eu- and pseudo-globulin and for horse albumin and globulin fractions. J. W. S.

Analysis of shape double-refraction curves. A. Frey-Wyssling (Kolloid-Z., 1940, **90**, 33—40).—The curves relating the double refraction of swollen materials with the n of the swelling medium are discussed, and it is shown that these are hyperbolic, with their axes inclined to the ordinate. J. W. S.

Simplification of certain calculations based on the mass law. J. D. Parent (J. Chem. Educ., 1940, **17**, 186—187).—Simplified solutions of mass law expressions for dissociation and hydrolysis are discussed. L. S. T.

Thermal cracking of free hydroxyl and water molecules into their atoms. H. Zeise (Feuerungstech., 1940, **28**, 1—2).—The equilibrium consts. and corresponding degrees of thermal cracking of H_2O into $2H + O$ are calc., for some temp. between 1000° and 3000° K. and 1 atm. pressure, by combining the two previously calc. equilibria $H_2 \rightleftharpoons 2H$ and $H_2O \rightleftharpoons H_2 + O$. The consts. and degree of cracking are also calc. for the thermal reaction $OH = O + H$ for temp. of 500—3000° K. and pressures of 0·1—20 atm. R. B. C.

Thermodynamic properties of the PN molecule. K. J. McCallum and E. Leifer (J. Chem. Physics, 1940, **8**, 505).—Thermodynamic functions of the PN mol. have been calc. from spectroscopic data for temp. between 100° and 1000° K. and the equilibrium consts. (K) for the reaction $P_2 + N_2 \rightarrow 2PN$ have been evaluated for 800°, 900°, and 1000° K. The calc. val. of K at 800° K. is not in accord with the experimental result of Moureu and Wetroff (A., 1939, I, 41) that at 800° K. PN is completely dissociated into P_2 and N_2. W. R. A.

Redistribution reactions. A. E. Stearn (J. Amer. Chem. Soc., 1940, **62**, 1630).—The "redistribution reactions" (A., 1940, II, 8) in which the equilibrium const. is independent of temp. are such that, with the exception of certain steric effects, the linkings formed are exactly similar to those which are broken, and so it is to be expected that $\Delta H = 0$. In such reactions the equilibrium const. can be calc. from the relative external symmetry nos. of the mols. involved. J. W. S.

Magnitude of the solvent effect in dipole moment measurements. III. Polarisation and association of alcohols in the liquid phase. F. R. Goss (J.C.S., 1940, 888—894).—On the basis of equations previously developed (cf. A., 1938, I, 136; 1940, I, 354) ideal polarisation vals. for alcohols have been evaluated assuming non-association. The ratio of these vals. to observed vals. for alcohols admixed with C_6H_6 is a measure of the association factor (α). For straight-chain alcohols α can be represented by $0{\cdot}2n^{2/3} + 1$ (n = no. of C). The calc. ideal dielectric consts. of unassociated alcohols indicate that in dil. C_6H_6 solution such alcohols are unassociated. C. R. H.

Influence of solvent on the strength of the hydrogen bridge. E. A. Moelwyn-Hughes (J.C.S.,

1940, 850—855).—The distribution of AcOH between H_2O and C_6H_6 has been determined at seven temp. over the range 17—62°. The experimental vals. for the partition ratio agree with vals. calc. from $c_B/c_W = K_1 + c_W(2K_1^2/K_2)$, where K_1 = const. of the equilibrium between monomeric AcOH in the two solvents, K_2 = const. of the equilibrium between monomeric and dimeric AcOH in C_6H_6, and c_B and c_W = total concns. of AcOH in C_6H_6 and H_2O, respectively. The increase in internal energy due to dissociation of dimeric AcOH in C_6H_6 is $\sim$5400 g.-cal. < the corresponding val. for gaseous dissociation. The difference between the two energies is discussed with reference to the distance between the two mols. of the dimeride and to the arrangement of solvent mols. around the dimeride. C. R. H.

Dissociation of iodine. H. M. SPENCER (J. Chem. Physics, 1940, **8**, 503).—Polemical against Murphy (A., 1936, 936). W. R. A.

Complex calcium citrate. J. MUUS and H. LEBEL (Kong. dansk. Vidensk. Selsk., mat.-fys. Medd., 1936, **13**, No. 19, 14 pp.; Chem. Zentr., 1937, i, 3615—3616; cf. Hastings *et al.*, A., 1934, 1307).—The dissociation $[CaC_6H_5O_7]'$ (I) $\rightleftharpoons Ca^{\cdot\cdot} + C_6H_5O_7''$ has $p_K = 3{\cdot}21$ at 25°, with the ionic strength (μ) = 0·165, or $p_{K_0} = 4{\cdot}85$ at infinite dilution. Observations over a range of p_H show the existence of a second equilibrium, $[CaHC_6H_5O_7] \rightleftharpoons Ca^{\cdot\cdot} + HC_6H_5O_7''$, with $p_K = 2{\cdot}3$ at $\mu = 0{\cdot}110$. The Ba complex corresponding with (I) gives $p_K = 2{\cdot}69$ at $\mu = 0{\cdot}165$. K for the similar Ca complex with tricarballylic acid is $\sim$50 times that for (I). A. J. E. W.

Systems of acids and bases. N. F. HALL (J. Chem. Educ., 1940, **17**, 124—128).—A review. L. S. T.

Ionisation constant of monoethanolammonium hydroxide at 25° from electrical conductance measurements. V. SIVERTZ, R. E. REITMEIER, and H. V. TARTAR (J. Amer. Chem. Soc., 1940, **62**, 1379—1382).—The conductivities of various solutions of NaOH, KOH, and $OH{\cdot}[CH_2]_2{\cdot}NH_3{\cdot}OH$ (I) and $OH{\cdot}[CH_2]_2{\cdot}NH_3Cl$ have been measured at 25° and lead to a val. of 197·56±0·15 for the limiting conductivity of the OH′ ion. The thermodynamic dissociation const. of (I) at 25° is $3{\cdot}19 \times 10^{-5}$. J. W. S.

Distribution of protons between water and other solvents. L. S. GUSS and I. M. KOLTHOFF (J. Amer. Chem. Soc., 1940, **62**, 1494—1496).—The effect of traces of H_2O on the colour of Me-yellow in dil. solutions of HCl in MeOH, EtOH, and Bu^aOH has been investigated. The vals. of the equilibrium const. of the reaction $ROH + H_3O^{\cdot} \rightleftharpoons ROH_2^{\cdot} + H_2O$ in these solvents are 0·23, 0·059, and 0·033, respectively, whilst the dissociation consts. of Me-yellow in the solvents are $10^{-3{\cdot}3}$, $10^{-3{\cdot}1}$, and $10^{-3{\cdot}1}$, respectively. J. W. S.

Increases in the acid strength of hydrogen chloride in dioxan brought about by phenols and alcohols. P. D. BARTLETT and H. J. DAUBEN, jun. (J. Amer. Chem. Soc., 1940, **62**, 1339—1344).—The acidity of solutions of HCl in dioxan, as measured with an indicator, is increased by the addition of phenols or alcohols, the effect being attributed to H-bond formation between the OH group and the Cl atoms of the HCl mol. This bond formation appears to increase with the strength of the phenol as an acid excepting in the presence of *o*-substituents capable of intramol. H-bonding, when the mols. are less efficient "acceptors" than would be expected from their strength as acids. This deviation is regarded as an argument against using the term acidity to cover activity as an electron acceptor. The behaviour is correlated with the mechanisms of the Wagner–Meerwein rearrangement and the solvolysis of *sec.* and *tert.* halides. J. W. S.

Thermodynamic dissociation constants of dibasic acids. J. C. SPEAKMAN (J.C.S., 1940, 855—859).—First and second dissociation consts. of $H_2C_2O_4$, succinic, glutaric, and adipic acids have been potentiometrically determined at 20°. A modified method of evaluating the consts. from slopes and intercepts of linear plots of experimental data is described. C. R. H.

Physicochemical studies of complex acids. XIV. Vanadic acid. H. T. S. BRITTON and G. WELFORD (J.C.S., 1940, 764—769; cf. A., 1930, 860; 1932, 814; 1935, 35).—Vanadic acid in solution at 5—90° behaves as a strong dibasic polyacid, $H_2[(V_2O_5)_{2{\cdot}5}O]$. The anion $[(V_2O_5)_{2{\cdot}5}O]''$ is stable to NaOH in the cold, but at higher temp. affords successively VO_3', V_2O_7'''', and VO_4'''. On treatment with HCl this process is reversed in hot but not in cold solutions. F. J. G.

Physicochemical studies of complex acids. XV. Basic nature of vanadium pentoxide. H. T. S. BRITTON and G. WELFORD (J.C.S., 1940, 895—899).—Strong acids ppt. V_2O_5 from Na_3VO_4 solutions before the stoicheiometric amounts have been added. Further additions of acid redissolve V_2O_5. Pptn. begins when approx. 2·7 equivs. of acid per mol. of Na_3VO_4 have been added, and redissolution begins when 5 equivs. of HCl or HNO_3 or 7·5—9·0 equivs. of H_2SO_4 per atom of V have been added. These facts together with solubility data for V_2O_5 in acids are evidence for the amphoteric nature of V_2O_5. It is probable that hydrolysis limits the combination of V_2O_5 and acids to the stage represented by VO_2Cl. C. R. H.

Physicochemical studies on the alkali carbonates. I. Hydrogen ion activity in aqueous solutions of alkali carbonates. L. LORTIE and P. DEMERS (Canad. J. Res., 1940, **B**, **18**, 160—167).—Vals. of p_H at 25° for aq. K_2CO_3 and Na_2CO_3 are recorded. The graph of p_H against log concn. is linear at $\not>$1M., and the p_H of K_2CO_3 solutions is > that of Na_2CO_3 solutions of the same concn. F. J. G.

Thermodynamic study of bivalent metal halides in aqueous solution. I. Activity coefficients of magnesium halides at 25°. R. A. ROBINSON and R. H. STOKES. **II. Activity coefficients of calcium, strontium, and barium chloride at 25°.** R. A. ROBINSON. **III. Activity coefficients of potassium and cadmium iodide at 25°.** R. A. ROBINSON and (MISS) J. M. WILSON. **IV. Thermodynamics of zinc chloride solutions.** R. A. ROBINSON and R. H. STOKES (Trans.

Faraday Soc., 1940, **36**, 733—734, 735—738, 738—740, 740—748).—I. Osmotic and activity coeffs. at 25° based on isopiestic measurements are given for $MgCl_2$ (0·1—2·0M.), $MgBr_2$ (0·1—1·8M.), and MgI_2 (0·1—1·6M.).

II. Activity coeffs. at 25°, derived from isopiestic measurements, are given for $CaCl_2$, $SrCl_2$, and $BaCl_2$. Those for $CaCl_2$ agree with vals. obtained from f.p. data, but not with those obtained independently by different authors from e.m.f. data, although the latter agree among themselves. This suggests that the Ca amalgam electrode is not reversible. Those for $SrCl_2$ and for $BaCl_2$ are in satisfactory agreement with e.m.f. data. Measurements of the isopiestic ratio between solutions of KCl and of 2KCl + $BaCl_2$ indicate that each salt retains its identity and ionises normally; there is no evidence of complex ion formation.

III. Activity coeffs. at 25°, derived from isopiestic measurements, are given for KI and for CdI_2. They are in good agreement with e.m.f. data.

IV. The e.m.f. of the cell: Zn–Hg (2-phase)| $ZnCl_2$|AgCl,Ag has been determined at 10—40°, and vals. of the standard electrode potential, activity coeffs., partial mol. heat contents, and partial mol. heat capacities have been calc. and are given in tables. The activity coeffs. at 25° have also been determined from isopiestic data. The standard electrode potential at 25° is 0·7625 v. F. J. G.

Heats of dilution, heat capacities, and activities of carbamide in aqueous solutions from the freezing points to 40°. F. T. GUCKER, jun., and H. B. PICKARD (J. Amer. Chem. Soc., 1940, **62**, 1464—1472).—The heats of dilution of 0·15—12M. aq. $CO(NH_2)_2$ have been determined at 25°. At low concn. the heat of dilution varies linearly with concn. By combination of the results with the heat capacity of the solutions at 2—40° (A., 1938, I, 23) equations have been derived for the variation with temp. of the heat of dilution and the partial relative mol. heat contents of $CO(NH_2)_2$ and H_2O. The data are also applied to the determination of the osmotic coeff. from measurements of the f.p. and v.p. at 0°, 10°, and 50°. J. W. S.

Transition temperatures of the liquid–solid phases of trimethyl phosphate. H. A. PAGEL and W. A. SCHROEDER (J. Amer. Chem. Soc., 1940, **62**, 1837—1838).—Me_3PO_4 exists in two solid modifications which appear to be monotropic. The liquid–solid transition temp. for the stable α-modification is −46·1° and for the metastable β-modification −62·5°. F. J. G.

Phase equilibria in hydrocarbon systems. XXX. Propane–n-pentane system. B. H. SAGE and W. N. LACEY (Ind. Eng. Chem., 1940, **32**, 992—996).—From a study of the phase behaviour of C_3H_8–n-C_5H_{12} mixtures between 54° and 188° the sp. vol. and composition of coexisting phases of the system have been established. Compressibility factors, dew-point pressures, and properties in the crit. region are tabulated. The phase behaviour of C_3H_8 below its crit. temp. is in reasonable agreement with the behaviour of the ideal solution, but above the crit. temp. there are considerable divergences. n-C_5H_{12} follows the behaviour of ideal solutions reasonably well up to ~93°. C. R. H.

Liquid–vapour equilibria of furan systems. System furfuraldehyde–furfuryl alcohol. A. P. DUNLOP and F. TRIMBLE (Ind. Eng. Chem., 1940, **32**, 1000—1002).—Equilibrium data at 25 mm. Hg are recorded. C. R. H.

Binary liquid systems. II. Azeotropic composition of carbon tetrachloride–ethyl acetate mixtures as a function of the pressure. P. W. SCHUTZ and R. E. MALLONEE (J. Amer. Chem. Soc., 1940, **62**, 1491—1492; cf. A., 1939, I, 612).—Redetermination of the b.p. and composition of the azeotrope in the system CCl_4–EtOAc at various pressures indicates that the rate of increase of the CCl_4 in the azeotrope with decreasing pressure becomes greater as the pressure is diminished, in accord with the behaviour of other systems. J. W. S.

Organic molecular compounds.—See A., 1940, II, 275.

Chlorinates. III. Temperature–concentration equilibria in the systems methylene chloride–chlorine and methyl chloride–chlorine. Methylene and methyl perchlorides. IV. Temperature–concentration equilibria in the system hydrogen chloride–chlorine. Hydrogen perchlorides. J. A. WHEAT and A. W. BROWNE (J. Amer. Chem. Soc., 1940, **62**, 1575—1577, 1577—1578; cf. A., 1938, I, 197).—III. F.p.–composition curves indicate the existence of the *compounds* $2CH_2Cl_2,Cl_2$, m.p. −124·5°, CH_2Cl_2,Cl_2, m.p. −126·5°, $CH_2Cl_2,2Cl_2$, m.p. −117·5°, $2MeCl,Cl_2$, m.p. −120°, and $MeCl,Cl_2$, m.p. −122°.

IV. F.p.–composition curves indicate the existence of the *compounds* $2HCl,Cl_2$, m.p. −121°, and HCl,Cl_2, m.p. −115°. The structures of these compounds are discussed. J. W. S.

Hydration of anilides of normal fatty acids. B. A. TOMS (Nature, 1940, **145**, 1019—1020; cf. A., 1940, II, 125).—The amount of H_2O taken up by substituted amides of n-fatty acids, and the tenacity with which it is held, vary with the method of hydration. Dehydration curves show that hydrated stear- and palmit-anilide, but not myrist- and laur-anilide, are able to resist drying over fused $CaCl_2$ at ordinary pressure. H_2O of hydration is probably held in the interstices of micellar structure. L. S. T.

Deliquescence in carbamide and methylcarbamides. A. CLOW (Nature, 1940, **146**, 26; cf. A., 1937, I, 307).—V.p. curves for saturated aq. solutions of $CO(NH_2)_2$ (I), its nitrate, $NH_2·CO·NHMe$, $NH_2·CO·NMe_2$, and $CO(NHMe)_2$, are reproduced. The cryohydric point for the system (I)–H_2O lies at −11·3°. The humidities required to cause deliquescence in these compounds, expressed as a % of the max. v.p. of H_2O at 18°, are 80·1, >95, 70·0, 94·3, and 63·5, respectively. L. S. T.

Models of ternary systems. E. P. KAISER (Amer. Min., 1940, **25**, 374—375).—The construction of these models is described and illustrated. L. S. T.

Ternary systems involving *cyclo*hexene, water, and methyl, ethyl, and *iso*propyl alcohols. E. R. WASHBURN, C. L. GRAHAM, G. B. ARNOLD, and L. F. TRANSUE (J. Amer. Chem. Soc., 1940, **62**, 1454—1457).—Solubility relations and n vals. have been determined at 25° for the ternary systems of *cyclo*hexene (I) and H_2O with MeOH and EtOH and at 15°, 25°, and 35° for the system (I)–H_2O–$Pr^{\beta}OH$. The efficiencies of the alcohols in bringing about miscibility follow the order $Pr^{\beta}OH > EtOH > MeOH$. Increase of temp. from 15° to 35° causes only a slight decrease in the area in which conjugate solutions are formed. Pure (I) has d_4^{25} 0·8056, d_4^{15} 0·8151, and n_D^{25} 1·4434. J. W. S.

Sodium polyiodides. G. H. CHEESMAN, D. R. DUNCAN, and I. W. H. HARRIS (J.C.S., 1940, 837—839).—A study of the system NaI–I_2–H_2O shows that $NaI_4,2H_2O$ and probably $NaI_2,3H_2O$ exist at 0°. A phase diagram of the system at 0° has been constructed. Since polyhalides usually contain an odd no. of halide atoms, it is suggested that these polyiodides are mol. compounds of polyiodides with an odd no. of I atoms. C. R. H.

System magnesium sulphate, cadmium sulphate, and water at 25° and 40°. W. C. VOSBURGH, V. H. DIBELER, H. C. PARKS, and W. J. MILLER (J. Amer. Chem. Soc., 1940, 62, 1472—1473). —The double salt $MgSO_4,CdSO_4,14H_2O$ exists in equilibrium with saturated solutions at 40° but not at 25°. The transition point is ~30·2°. No other ternary compounds are formed. J. W. S.

Heterogeneous equilibria in aqueous solutions of sulphates of quinquevalent vanadium at 30°. O. E. LANFORD and S. J. KIEHL (J. Amer. Chem. Soc., 1940, **62**, 1660—1665).—The 30° isotherm of the system V_2O_5–SO_3–H_2O has been determined. There are five stable solid phases, viz., V_2O_5, V_2O_5,xH_2O (of variable composition), $V_2O_5,2SO_3,8H_2O$, $V_2O_5,2SO_3,3H_2O$, and $V_2O_5,4SO_3,4H_2O$. F. J. G.

Equilibrium measurements for the thermal reduction of magnesium oxide with silicon. A. SCHNEIDER and E. HESSE (Z. Elektrochem., 1940, **46**, 279—284).—The partial pressures of Mg over MgO and Si at 1200—1350° have been determined by the streaming method. The vals. correspond with a heat of reaction of −122 kg.-cal. at ~1250°. Comparison with thermochemical data shows that the reaction is probably $4MgO + Si \rightleftharpoons 2Mg_{vap.} + Mg_2SiO_4$, and X-ray diagrams of the products confirm this. The heat of formation of Mg_2SiO_4 from 2MgO and SiO_2 at ~1250° is estimated to be 33 kg.-cal. F. J. G.

Quaternary system acetic acid–chloroform–acetone–water at 25°. A. V. BRANCKER, T. G. HUNTER, and A. W. NASH (J. Physical Chem., 1940, **44**, 683—698).—Data obtained in a detailed study of this system and of the ternary systems $COMe_2$–$CHCl_3$–H_2O and $AcOH$–$CHCl_3$–H_2O are recorded in tabular and in triangular and tetrahedral diagram forms. C. R. H.

Heats of dilution of aqueous solutions of glycine at 25°. J. M. STURTEVANT (J. Amer. Chem. Soc., 1940, **62**, 1879).—Vals. for the heat of dilution at 25° are given. F. J. G.

Thermal data on organic compounds. XX. Modern combustion data for two methylnonanes, methyl ethyl ketone, thiophen, and six *cyclo*paraffins. G. E. MOORE, M. L. RENQUIST, and G. S. PARKS (J. Amer. Chem. Soc., 1940, **62**, 1505—1507; cf. A., 1940, I, 118).—Bomb-calorimeter determinations of the heats of combustion at 25° and const. vol. ($-\Delta U_R$) have been made for β- (I) and ε-methylnonane (II), methyl- (III) and ethyl-*cyclo*pentane (IV), *cyclo*hexane (V), methyl- (VI), *n*-heptyl- (VII), and *n*-dodecyl-*cyclo*hexane (VIII), COMeEt (IX), and thiophen (X), and the corresponding heats of combustion ($-\Delta H_R$) and heats of formation ($-\Delta H_f$) at const. pressure (1 atm.) are derived. $-\Delta U_R = 1614{\cdot}00 \pm 0{\cdot}56$ (I), $1614{\cdot}46 \pm 0{\cdot}38$ (II), $938{\cdot}58 \pm 0{\cdot}40$ (III), $1094{\cdot}40 \pm 0{\cdot}37$ (IV), $934{\cdot}62 \pm 0{\cdot}31$ (V), $1088{\cdot}35 \pm 0{\cdot}45$ (VI), $2021{\cdot}71 \pm 0{\cdot}55$ (VII), $2804{\cdot}30 \pm 0{\cdot}84$ (VIII), $581{\cdot}70 \pm 0{\cdot}20$ (IX), $665{\cdot}91 \pm 0{\cdot}60$ (X); $-\Delta H_R = 1617{\cdot}26$ (I), 1617·72 (II), 940·36 (III), 1096·47 (IV), 936·40 (V), 1090·42 (VI), 2025·56 (VII), 2809·63 (VIII), 582·59 (IX), 667·39 (X); $-\Delta H_f = 74{\cdot}54$ (I), 74·08 (II), 33·73 (III), 39·97 (IV), 37·69 (V), 46·02 (VI), 84·96 (VII), 112·63 (VIII), 66·80 (IX), −19·62 (X) kg.-cal. per mol. J. W. S.

Thermodynamics and the lowest temperatures. C. G. DARWIN (Nature, 1940, **145**, 954—958).—A lecture. L. S. T.

Derivation of the equilibrium conditions in physical chemistry on the basis of the work principle. J. N. BRØNSTED (J. Physical Chem., 1940, **44**, 699—712).—Theoretical. Concepts and methods of classical thermodynamics are criticised as lacking clarity. In all natural processes the loss of work is either zero (reversible reaction) or positive (irreversible reaction). Processes involving negative loss of work are not possible. Every transformation occurring through a state of equilibrium is reversible and the derivation of equilibrium equations must therefore be based on this work principle. The work theorem for infinitesimally diverging systems is derived from a consideration of the differential transport of a fraction of a homogeneous system from a certain state into another deviating infinitesimally from the first, and from it are developed several equilibrium equations in physical chemistry. C. R. H.

Brønsted's criticism of classical thermodynamics. F. H. MACDOUGALL (J. Physical Chem., 1940, **44**, 713—715).—The argument of Brønsted (cf. preceding abstract) that the classical treatment of thermodynamics lacks clarity is adversely criticised. C. R. H.

Dependence of conductance on field strength. II. Tetrabutylammonium bromide in diphenyl ether at 50°. D. J. MEAD with R. M. FUOSS (J. Amer. Chem. Soc., 1940, **62**, 1720—1723; cf. A., 1939, I, 525).—Conductance data for NBu_4Br in Ph_2O at 50° are given, over the concn. range 10^{-6}—10^{-3}N. at low voltage, and in the concn. range $0{\cdot}5$—$5{\cdot}0 \times 10^{-4}$N. at field strengths $\ngtr 20$ kv. per cm. and at 60, 600, and 1000 cycles. For low frequencies the Wien effect is in agreement with Onsager's theory, but at

higher frequencies, when the Langevin relaxation time becomes approx. the period of the field, the Wien coeff. decreases. F. J. G.

Mechanism of hydrogen electrode process. J. Horiuti (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 274—301).—Theoretical. The assumption of Frumkin in calculating the Tafel–Bowen–Rideal const. τ for the H-electrode process on Hg (A., 1938, I, 201) that the ideal gas law holds for H atoms on the electrode surface at overvoltages from 0·5 to 0·88 v. is unjustified. Calculation by Okamoto *et al.* (A., 1936, 1346) gives vals. of τ in agreement with the catalytic mechanism. The results of Lukovzev *et al.* (A., 1939, I, 614) are not in contradiction to the catalytic mechanism. O. D. S.

Silver–silver iodide electrode. R. K. Gould and W. C. Vosburgh (J. Amer. Chem. Soc., 1940, **62**, 1817—1819).—Vals. are recorded of the e.m.f. at 10—40° of the cell $H_2|HI|AgI,Ag$, with OAc′ buffer containing KI as electrolyte. The normal potential of the Ag–AgI electrode is $E^\circ = 0{\cdot}1519 + 0{\cdot}000328 \times (\theta - 25) + 0{\cdot}0000028(\theta - 25)^2$. F. J. G.

Aromatic hydrocarbons and their derivatives. XXIX. Calculation of the [reduction] potentials of quinones from the ordinal numbers of the corresponding hydrocarbons according to the anellation process. E. Clar (Ber., 1940, **73**, [*B*], 104—108; cf. A., 1936, 599, 1102; 1940, II, 273).—A study of a no. of polynuclear *o*- and *p*-quinones shows that their reduction potentials, $E_{o,K}$, are related to the ordinal nos. (K_o, K_p) of the corresponding hydrocarbons by $E_{o,K} = E_{o,\infty} + 1/R_{E,o} . K_o^4$ and $E_{o,K} = E_{o,o} - R_{E,p} . K_p^4$, respectively; $E_{o,\infty}$, $E_{o,o}$, $R_{E,o}$, and $R_{E,p}$ are consts., the derivation of which is described. $E_{o,K}$ is always positive for *o*-quinones, but rapidly becomes negative for *p*-quinones as K_p increases. An unreactive hydrocarbon normally gives a very reactive quinone, and conversely; this can be explained by an anellation process. A. J. E. W.

Polarographic researches in a non-aqueous medium. G. Sartori and G. Giacomello (Gazzetta, 1940, **70**, 178—186).—The deposition potentials of Li at a Hg cathode from solutions of LiCl in MeOH and in MeOH–H_2O and MeOH–C_6H_6 mixtures have been measured. Deposition potentials of Zn from solutions of $Zn(NO_3)_2$ and LiCl in MeOH and of Cd from solutions of $Cd(NO_3)_2$ and LiCl in MeOH are also recorded. O. J. W.

Anodic properties of the aluminium cell. W. B. Pietenpol and T. E. Devaney (Physical Rev., 1938, [ii], **53**, 325).—The theory, previously proposed, that in the Al cell the active film is composed of colloidal Al_2O_3,nH_2O, which partly traps anions but allows cations to pass, is substantiated by resistance and other data. L. S. T.

Influence of electrolytes on the hallo-electric effect. P. H. Burdett, J. E. Magoffin, and F. K. Cameron (Text. Res., 1940, **10**, 149—166).—An apparatus is described for measuring the charge on drops of H_2O or aq. solution sprayed from an atomiser. The negative charge on pure H_2O increases slightly at very low salt concns., but decreases at higher concns. It is not reversed at any concn. of univalent cations, but is reversed in 6×10^{-4}M-$CrCl_3$. The relation between V and log C is linear, and the slope of the curve and the intercept on the V axis are related to the effective radii of the cation and anion, respectively, but not to the valency. The p.d. does not arise from separation of the components of the double layer. W. A. R.

Dielectric behaviour of anodic aluminium during its formation. A. Miyata (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 147—176).—The effect of an insulating film on the formation process has been studied by measurements of the series equiv. capacitance and the loss angle of the active layer. These quantities increase with the forming current at low, but not at high, frequencies. The behaviour of bare and filmed Al differs considerably. L. J. J.

Frequency characteristics of anodic aluminium during formation. A. Miyata (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 177—204).—Measurements of the loss angle and equiv. series capacitance have been carried out on bare and filmed Al in a neutral solution at c.d. 25 ma. per sq. dm., and frequencies 50—104 cycles. The results correspond with a simple equiv. network. The capacitance of the active layer is inversely $\propto$ the forming voltage. The different behaviour of bare and filmed Al in a no. of solutions is in agreement with the interpretation given. L. J. J.

Diffusion processes in electrolysis with the dropping mercury electrode and with stationary micro-electrodes. H. A. Laitinen and I. M. Kolthoff (Suomen Kem., 1940, **13**, **B**, 4—8; cf. A., 1940, I, 106).—The relation between current and time in electrolyses where electrolyte reaches one of the electrodes by diffusion only has been studied mathematically for the cases, linear to planar, spherically symmetrical to stationary spherical, and spherical diffusion to dropping Hg electrodes. The equations have been investigated experimentally using special Pt micro-electrodes with 0·0001M-$K_4Fe(CN)_6$ in 0·1N-KCl at 25°. Agreement with theory (to 0·5%) was found with upward linear diffusion only, convection currents due to density gradients interfering in all other cases. In stiff 3% agar gel symmetrical spherical diffusion gave vals. near the theoretical. With dropping Hg electrodes the diffusion layer is never >0·05 mm. and vals. are in agreement with theory since convection is negligible. M. H. M. A.

Electrometric studies on the precipitation of hydroxides. XV. Amphoteric nature of vanadium tetroxide. XVI. Vanadous hydroxide. Nature of vanadous chloride and sulphate solutions. H. T. S. Britton and G. Welford (J.C.S., 1940, 758—761, 761—764).—XV. In earlier observations (A., 1935, 35) of the pptn. of $VO(OH)_2$ by NaOH, the formation of a sparingly sol. Na vanadite was overlooked. Further work indicates that in both HCl and H_2SO_4 solutions V^{IV} is present as VO salts, which do not further react with acid; NaOH ppts. $VO(OH)_2$ which with excess of NaOH affords Na_2O,V_2O_4,xH_2O.

XVI. Brown V^{III} solutions contain sol. basic salts; green solutions in HCl contain VCl_3, those in H_2SO_4 contain an acid salt, $H_2SO_4,V_2(SO_4)_3$, or complex acid, $HV(SO_4)_2$. Pptn. of $V(OH)_3$ occurs at p_H 4—5, from solutions having the approx. compositions $V(OH)_2Cl$ and $V(OH)SO_4$. $V(OH)_3$ is not amphoteric. F. J. G.

Current distribution and throwing power in electrolytes. A. VON ENGEL (Nature, 1940, **146**, 66).—A theoretical and experimental investigation of the current distribution between plane electrodes at variable spacings in a non-uniform field is outlined. L. S. T.

Reactions in melts. H. LUX (Naturwiss., 1940, **28**, 92).—Reactions occurring in melts containing inorg. oxides can be investigated by making use of the fact that noble metals, such as Au, acquire a definite potential when placed in a melt, the val. of the potential depending on the concn. of alkali oxide. In strongly alkaline melts, the alkali oxide appears to be thermally dissociated, so that a Au–alkali metal electrode is formed. Using this method, B_2O_3 and $NaPO_3$ are strongly acid melts at 950°, Na_2SO_4, Li_2SO_4, and $Na_2B_4O_7$ are neutral, and Na_2CO_3, Li_2CO_3, and Na_3BO_3 are strongly alkaline. The Na_2SO_4–K_2SO_4 eutectic may be used as an indifferent solvent. If Na_2O or Li_2O is dissolved in the eutectic, the potential set up depends only on the solvent and not on the oxide dissolved. At the high temp. used (950°), peroxides, carbonates, nitrates, and nitrites decompose more or less rapidly, and therefore give identical potentials. Weakly basic oxides, such as MgO, BeO Al_2O_3, La_2O_3, and ZnO, are insol. under the above conditions. The reaction between acidic oxides and alkali oxide dissolved in the melt can be followed. A. J. M.

Absolute reaction rates and the photovoltaic effect. E. ADLER (J. Chem. Physics, 1940, **8**, 500—501).—Methematical. W. R. A.

Latent energy and dissociation in flame gases. W. T. DAVID and B. PUGH (Nature, 1940, **145**, 896—897).—Temp. determinations in flame gases (CO + air, and CO + H_2 + air) by means of quartz-covered Pt and uncovered Pt–Rh wires support the view that a proportion of the newly-formed triat. mols. hold an excess of intramol. energy that cannot be handed over to the translational degrees of freedom, and that by virtue of this excess energy dissociation in flame gases is $\gg$ in normal gases of the same composition under similar conditions. L. S. T.

Latent energy and dissociation in explosions. A. S. LEAH (Nature, 1940, **145**, 897—898).—Data recorded for explosions of CO + air in closed vessels confirm the views of David and Pugh (cf. preceding abstract), and indicate the dependence of abnormal dissociation on latent energy. L. S. T.

Thermal reaction between hydrogen and oxygen. I. Comparison of experiments and theory. O. OLDENBERG and H. S. SOMMERS, jun. (J. Chem. Physics, 1940, **8**, 468—476).—Defects and difficulties of the present theories of the slow thermal reaction between H_2 and O_2 are discussed. W. R. A.

Reactions of methyl radicals with benzene, toluene, diphenylmethane, and propylene. H. S. TAYLOR and J. O. SMITH, jun. (J. Chem. Physics, 1940, **8**, 543—546).—The formation of CH_4 by the reaction of Me, from $HgMe_2$, with C_6H_6, PhMe, CH_2Ph_2, and propylene (I) has been investigated from 100° to 260°. The activation energies with PhMe and (I) are, respectively, 5·6 and 3 kg.-cal., whilst CH_2Ph_2 gives a much lower and C_6H_6 a much higher val. Correlation of activation energies with (i) previous data on saturated hydrocarbons (A., 1939, I, 481), (ii) thermal data indicating C–H bond strengths in individual mols., (iii) data on the interaction of Na with halide compounds, (iv) concepts of org. chemistry, and (v) data on the pyrolysis of PhMe (A., 1938, II, 13) shows that, contrary to accepted views, the strengths of C–C and C–H bonds may have markedly different vals. among the various hydrocarbons. W. R. A.

Kinetics of a diene association under constant volume conditions. D. M. NEWITT and A. WASSERMANN (J.C.S., 1940, 735—737).—Work previously noted (A., 1939, I, 269; 1940, I, 29) affords data from which the activation energy at const. vol., E_v, for the association of liquid *cyclo*pentadiene, and the corresponding non-exponential factor, A_v, are calc. Unlike the corresponding quantities for const. pressure, A_v and E_v are independent of pressure and are therefore more characteristic of the kinetics in the condensed state. E_v (pure liquid)/E_v (gas) is $\sim$3·2 kg.-cal. and A_v (pure liquid)/A_v (gas) is $\nless$40, and probably $\sim$400. F. J. G.

Relation between activation energies of reactions in solution and dielectric constants of the media. Measurement of activation energies in solution. D. P. EVANS and H. O. JENKINS (Trans. Faraday Soc., 1940, **36**, 818—823; cf. A., 1940, I, 30).—Analysis of published data indicates that the activation energy E of reactions in solution may be represented with reasonable accuracy by $E = E_B + E_R/\epsilon$, in which the first term denotes the bond-stretching energy and the second the repulsion energy E_R, ϵ being the dielectric const. of the liquid. Determination of E for a particular reaction in solvents of varying ϵ permits the approx. evaluation of E_B and E_R, provided the solvents used are of similar type. Variation of E with ϵ is to be expected only when E_R is a sufficiently large fraction of E, as it is in reactions involving one or more ions. The validity of the usual method of determining E is doubtful in cases where E_R is large, since ϵ for many solvents varies considerably with temp. F. L. U.

Mechanism of the reaction between persulphate and alkyl iodide. M. S. TELANG and V. V. NADKARNY (Current Sci., 1940, **9**, 226—227).—The reaction between $K_2S_2O_8$ and EtI is unimol. (A., 1940, I, 121) whereas that between $K_2S_2O_8$ and KI is bimol. The first-order mechanism is explained as arising from a slow primary dissociation of EtI with production of an I atom or ion which is oxidised by S_2O_8'' ions in a fast reaction. The free Et radical may be oxidised also by a fast reaction. Since the velocity of the reaction is increased by $H^{\cdot}$ ions the dissociation of EtI to $C_2H_4 + H^{\cdot} + I'$ or (with

H_2O) to EtOH + H$^{\cdot}$ + I$'$ is improbable and the most likely mode is EtI → Et + I. In HNO_3 no I is liberated, whereas with $K_2S_2O_8$ and H_2O_2 I is given off, indicating the dual rôle of $K_2S_2O_8$ as an oxidising agent and a catalyst. $K_2S_2O_8$ appears to oxidise Et to EtO·O· (very reactive) radicals which combine with EtI to give $(EtO\cdot)_2$ + I. W. R. A.

Kinetics of the reaction of *p*-methoxybenzhydryl chloride with methanol in dilute nitrobenzene solution. P. D. BARTLETT and R. W. NEBEL (J. Amer Chem. Soc., 1940, **62**, 1345—1349).—The reaction of *p*-OMe·C_6H_4·CHPhCl (I) with MeOH (0·07—0·21M.) in $PhNO_2$, saturated with NEt_3,HCl, in presence of NEt_3 at 25° is apparently bimol., but is affected by the [MeOH] and is actually a mixed bi- and ter-mol. reaction, the latter involving 2 mols. of MeOH. The amount of the termol. reaction decreases with larger initial amounts of MeOH. The solubility of NEt_3,HCl in $PhNO_2$ is notably increased by MeOH, and increasing amounts of NEt_3 decrease the rate of alcoholysis. These facts indicate formation of NEt_3,HCl,MeOH and some NEt_3,HCl,2MeOH, and of Et_3N···HOMe, and attachment of 1 or more MeOH by the H to the Cl of (I). V.p. measurement shows MeOH to be unassociated in $PhNO_2$ (up to 0·6M.). NEt_3 is inert to (I) in $PhNO_2$, but piperidine slowly reacts. If the $PhNO_2$ is not saturated with NEt_3,HCl, the reaction is abnormally fast until pptn. begins. R. S. C.

Chemical constitution and reactivity. I. Phenyldiazonium chloride and its mono-substituted derivatives. M. L. CROSSLEY, R. H. KIENLE, and C. H. BENBROOK (J. Amer. Chem. Soc., 1940, **62**, 1400—1404).—The decomp. of PhN_2Cl in dil. HCl of p_H 1·75 is a first-order reaction, with heat of activation 27,200 g.-cal. per g.-mol. The yield of PhOH decreases with increasing concn., and in very conc. solution is only 24%, the other products being PhCl, C_6H_6, and Ph_2. The reaction velocity increases slightly with increasing [HCl], but decreases again in >10N-HCl; in D_2O it is approx. the same as in H_2O. When the initial p_H of the solution is < 11·2, the p_H falls during the decomp. to ~2, whereas when the initial p_H is >11·6 it falls only to ~10. In buffered solutions the proportion of the N evolved as N_2 is the greater the lower is the p_H. With the exception of *o*-OMe·$C_6H_4N_2Cl$, the decomp. of which appears to be autocatalytic, derivatives of PhN_2Cl show similar behaviour. *m*-OH, *o*- or *m*-Me, *m*-OMe, and *o*- or *m*-Ph as substituents decrease the stability of the mol., whereas other substituents increase its stability. J. W. S.

Saponification of ethyl esters of aliphatic acids. H. S. LEVENSON and H. A. SMITH (J. Amer. Chem. Soc., 1940, **62**, 1556—1558).—The velocities of hydrolysis (v) of Et laurate, β-methylvalerate, and *iso*hexoate, $Pr^{\beta}CO_2Et$, $CHEt_2$·CO_2Et, $CHPr^{\alpha}{}_2$·CO_2H, and $CHBu_2$·CO_2Et in 85% aq. EtOH have been studied at 25—55°, and the heats of activation of the reactions are deduced. The results indicate that, as in the case of the corresponding esterification reactions, an increase of chain length beyond 4 C atoms has no measurable effect on v, whilst only when a Me is substituted for an α- or β-H does it affect v. J. W. S.

Precipitation of silver chromate. A. VAN HOOK (J. Physical Chem., 1940, **44**, 751—764).—When Ag_2CrO_4 is formed from equiv. amounts of $AgNO_3$ and K_2CrO_4 there is a preliminary first-order reaction for the formation of nuclei followed by a second-order reaction for their growth. The velocity equations representing these two stages gradually lose their validity as non-equivalence of the reactants is increased. Adsorption and aggregation are pronounced at high supersaturations and high non-equivalence. C. R. H.

Absorption of carbon dioxide in aqueous alkalis. H. J. WELGE (Ind. Eng. Chem., 1940, **32**, 970—972).—Theoretical. The rate of absorption of CO_2 by aq. alkalis is approx. ∝ [alkali]$^{\frac{1}{2}}$ if η changes and variations in CO_2 solubility are neglected. Reaction rate coeffs. obtained directly agree with those calc. from absorption data. The influence of changes in liquid film thickness as a result of different methods of agitation on absorption and on HCO_3' and CO_3'' diffusion is considered. Gentle agitation leads to thicker films and slower absorption rates. C. R. H.

Rate of recrystallisation in polycrystalline solids. L. A. YOUNG (Physical Rev., 1938, [ii], **53**, 686).—A theory of rate curves for the transformation of a polycryst. solid into an allotropic modification, based on nucleation and subsequent growth of nuclei, is developed. The effect of impurities, change in temp., etc. on the rate of nucleation and on the rate of growth of nuclei can be determined separately. L. S. T.

Kinetic decomposition of ethyl chloroformate. II. Foreign gas effects. A. R. CHOPPIN and G. F. KIRBY, jun. (J. Amer. Chem. Soc., 1940, **62**, 1592—1594; cf. A., 1940, I, 28).—The velocity (v) of decomp. of $ClCO_2Et$ has been studied at 175° and in presence of various gases. No measurable equilibrium effect could be detected during experiments in presence of CO_2, which, like N_2 and O_2, is effective in maintaining the high-pressure energy distribution. H_2 is ineffective for this purpose. C_6H_6 and CCl_4 decrease v slightly, whilst C_6H_{14} causes a slight increase. Cl_2 has a positive catalytic effect which is not ∝ [Cl_2]. The products formed on addition of H_2O cause slight catalysis. N_2O causes a slight decrease in v, whilst NO, after an initial induction period, increases it. The data suggest that the reaction involves internal rearrangements with the elimination of CO_2. J. W. S.

Kinetics of the reaction of iodine with hypophosphorous acid and with hypophosphites. R. O. GRIFFITH, A. MCKEOWN, and R. P. TAYLOR (Trans. Faraday Soc., 1940, **36**, 752—766; cf. A., 1934, 970; 1937, I, 248).—The oxidation of H_3PO_2 and of hypophosphites by I has been studied at 30—60°, over the p_H range 1—8 and in presence of a no. of acid catalysts. The results are in accordance with a reaction scheme involving the following individual reactions: (1) oxidation of the ion H_2PO_2' to H_2PO_3'; this is slow, and independent of p_H; it has E = 25,200 g.-cal.; (2) oxidation of H_3PO_2; this is subject to general acid catalysis, the measured rate being that of the conversion of "normal" into "active"

H_3PO_2, via both $H_4PO_2^{\cdot}$ and H_2PO_2'. The catalytic coeffs. of a large no. of acids for the former process have been determined; the Brönsted relationship is followed, except in the case of $H_3O^{\cdot}$. The occurrence of the latter process has been established but it was not studied quantitatively. The effective agent in the oxidation of H_2PO_2' is the I_2 mol.; in that of active H_3PO_2 both I_2 and the I_3' ion are effective, the sp. rate for the former being the greater by a factor $\sim 3 \cdot 5$. For the activation of H_3PO_2 by $OH_3^{\cdot}$, $E = 25{,}000$ g.-cal. F. J. G.

Kinetics of the reaction of iodine with phosphorous acid and with phosphites. R. O. GRIFFITH and A. MCKEOWN (Trans. Faraday Soc., 1940, **36**, 766—779; cf. A., 1937, I, 248).—The oxidation of H_3PO_3 and of phosphites by I has been studied at 0—45° over the p_H range 0·5—9 and in presence of a no. of acid catalysts. In neutral and feebly acid solution the only process is a reaction between HPO_3'' ions and I_2 mols., having $E = 22{,}000$ g.-cal. and an abnormally high steric factor. In strongly acid solution ($p_H < 1$) the reaction proceeds by a mechanism analogous to that of the oxidation of H_3PO_2 (cf. preceding abstract) and exhibits general acid catalysis. The catalytic coeffs. of a no. of acids have been determined, and, with the exception of OH_3^+, the Brönsted relationship is followed. The crit. increment of the acid-catalysed process H_3PO_3 + acid = $H_4PO_3^{\cdot}$ + base is 22,500 g.-cal. The sp. rate of oxidation by I_2 mols. is ~ 4 times that by the I_3' ion. F. J. G.

Kinetics of the catalysed polymerisation of styrene. III. Mechanism of metal chloride catalysis. G. WILLIAMS (J.C.S., 1940, 775—784).—The effects of BCl_3, $SnCl_4$, and $SbCl_5$ as catalysts for the polymerisation of styrene have been studied at 25° in CCl_4, $CHCl_3$, C_6H_6, and PhMe. The rate of polymerisation with $SnCl_4$ is $\sim 10^3$ times that with BCl_3, and with $SbCl_5$ it is greater still. The chain length of the polymeride is independent of the concn. of catalyst, but approx. $\propto$ [styrene]$^{\frac{1}{2}}$. The course of the reaction is represented by $-d(a-x)/dt = kca(a-x)^3$, where c = concn. of catalyst, a = initial concn. of styrene, and x = concn. of polystyrene after time t. In CCl_4 at 25°, with $SnCl_4$ as catalyst, $k \sim 7 \times 10^{-2}$. The temp. coeff. is small, corresponding with an activation energy $\not> 3000$ g.-cal. A possible mechanism, in which the function of the catalyst is to facilitate triple collisions between styrene mols., is discussed. (Cf. A., 1938, I, 204, 464.) F. J. G.

Kinetics of the esterification of substituted benzoic acids. R. J. HARTMAN and A. G. GASSMANN (J. Amer. Chem. Soc., 1940, **62**, 1559—1560).—The velocity of the $H^{\cdot}$-catalysed reaction between MeOH and BzOH and its substitution products has been studied at 25°, 40°, 50°, and 60°. The energy of activation of the reaction with BzOH is 15,500 g.-cal. per g.-mol. Substituents (*o*-, *m*-, and *p*-I, -F, -OMe, and -OEt) all lower this val. The effects of substituents on the velocity coeffs. of the reaction are in accord with Hammett's equation, except in the cases of *p*-OEt, -OMe, and -F, with which the velocity is < the calc. val. J. W. S.

Surface conditions of silver halides and the rate of reaction. II. Reduction of nucleated silver chloride. III. Reduction of silver chloride by hydrazine. T. H. JAMES (J. Amer. Chem. Soc., 1940, **62**, 1649—1654, 1654—1658; cf. A., 1940, I, 223).—II. The kinetics of reduction of pptd. AgCl by NH_2OH have been studied with special reference to the effect of the previous history of the ppt. (nucleation by exposure to light and by preliminary treatment with NH_2OH). The reaction begins at active spots on the surface, the no. of which is controlled by the previous history of the ppt., and not by the reaction conditions. $CuSO_4$ accelerates the reaction and changes its character, apparently by catalysing reduction of $Ag^{\cdot}$ ions in solution.

III. The reduction of pptd. AgCl by N_2H_4 has been compared with that by NH_2OH. The results indicate that with N_2H_4 the reduction in solution predominates. It is catalysed by colloidal Ag, and very markedly by $Cu^{\cdot\cdot}$ ions. Applications to the theory of photographic development are discussed. F. J. G.

Catalytic isotope exchange of gaseous oxygen. VI. Exchange reaction of the oxygen atoms between oxygen and water vapour on the surface of the oxides of [elements in] the second, fourth, and sixth groups of the periodic system. 2. Theoretical. VII. Mechanism of the exchange of oxygen atoms between oxygen and water vapour on the surface of calcium oxide. N. MORITA (Bull. Chem. Soc. Japan, 1940, **15**, 71—76, 119—129).—VI. Experimental data already recorded (A., 1940, I, 262) are discussed. The catalytic activity of an oxide for the exchange reaction is in general little influenced by the mode of prep. An exception is SnO_2, and here promoter action of impurities may be responsible for the variation. In any one period the group IV oxide has the least activity, in accordance with the view that activated adsorption of either H_2O (on stable, easily hydrated oxides) or O_2 (on oxides having relatively high decomp. pressure) is the determining factor. In group IIA the activity increases, and in group VIA decreases, with increasing at. wt., corresponding respectively with increasing ease of hydration and increasing stability of the oxides.

VII. No appreciable sorption or desorption of O_2 on CaO, and no appreciable exchange of ^{18}O between CaO and O_2, occurs at <600°. On the other hand ^{18}O is freely exchanged between H_2O and CaO at 400°, the % exchange then decreasing with rising temp. When H_2O containing ^{18}O is absorbed by CaO and subsequently driven off at high temp., the % exchange corresponds with ~ 2 mols. of H_2O per mol. of CaO, suggesting that a polyhydrate $CaO(H_2O)_x$ ($x > 1$ and probably = 2) is involved. The mechanism of exchange between O_2 and H_2O is then $CaO(H_2O)_x + H_2O \rightleftharpoons CaO(H_2O)_{x+1}$; $CaO(H_2O)_{x+1} + 0{\cdot}5O_2 = CaO(H_2O)_x(H_2O_2)$; $CaO(H_2O)_x(H_2O_2) = CaO(H_2O)_x + H_2O + 0{\cdot}5O_2$. F. J. G.

Catalytic isotope exchange of gaseous oxygen. VIII. Effect of time of contact of the reactive gas mixture with the catalyst on the rate of the exchange reaction. N. MORITA (Bull. Chem. Soc. Japan, 1940, **15**, 166—180; cf. A., 1940, I, 262).

—The rate of mass exchange on Al_2O_3, Pt, and spongy Pt surfaces is inversely ∝ velocity of gas flow. The activity of the catalyst, expressed as the temp. at which a definite % mass exchange is attained, is only slightly affected by the velocity of gas flow or the amount of catalyst used. D. F. R.

Mixed catalysts. V. N. IPATIEV (Science, 1940, **91**, 605—608).—An address. L. S. T.

Investigation of catalysts with the universal electron microscope. M. VON ARDENNE and D. BEISCHER (Angew. Chem., 1940, **53**, 103—107).—The application of the electron microscope in examination of the surface condition and fineness of division of materials used as catalysts is discussed. J. W. S.

Catalytic oxidation. L. D. JOHNSON (J. Chem. Educ., 1940, **17**, 234—235).—10 c.c. of MeOH mixed with 15 c.c. of 3% H_2O_2 are dropped slowly on to heated MnO_2 to yield CH_2O. L. S. T.

New mechanism for the action of the vanadium pentoxide–silica–alkali pyrosulphate catalyst for the oxidation of sulphur dioxide. J. H. FRAZER and W. J. KIRKPATRICK (J. Amer. Chem. Soc., 1940, **62**, 1659—1660).—The mechanism put forward by Neumann (B., 1936, 144) assumes V^{IV} as an intermediate, and does not explain the rôle of the $K_2S_2O_7$. At 450° (the temp. at which the catalyst is used), V_2O_5 is sol. in fused $K_2S_2O_7$, and in this solution is reduced to V^{III} by SO_2. Further, V^{IV} undergoes disproportionation to V^{III} and V^{V} in fused $K_2S_2O_7$. Accordingly, the mechanism is: $V_2O_5 + K_2S_2O_7 + 2SO_2 = 2KV(SO_4)_2$; $2KV(SO_4)_2 + 2SiO_2 = K_2S_2O_7 + V_2Si_2O_7 + 2SO_3$; $V_2Si_2O_7 + O_2 = V_2O_5 + 2SiO_2$. F. J. G.

Catalytic oxidation of sulphur dioxide by heavy oxygen on the surface of spongy platinum. T. TITANI and S. NAKATA (Proc. Imp. Acad. Tokyo, 1940, **16**, 184—186).—On heating a mixture of O_2 and SO_2 no exchange of ^{18}O is observed below 400°, the temp. at which the SO_3 that is formed first commences to dissociate. The % exchange increases above 450° and attains a max. val. at 550°. D. F. R.

Sulphur dioxide reduction. Kinetics. R. LEPSOE (Ind. Eng. Chem., 1940, **32**, 910—918).—Experimental data on reaction rates are discussed with reference to earlier theoretical deductions (cf. A., 1938, I, 142). Although the reduction of SO_2 by C can be represented by $SO_2 + C \rightarrow CO_2 + 0{\cdot}5S_2$ followed by $CO_2 + C \rightarrow 2CO$, a discrepancy in the ratio of the velocity coeffs. suggests a third reaction of the first order at the coke surface with ash as catalyst, viz., $SO_2 + 2CO \rightarrow 2CO_2 + 0{\cdot}5S_2$. This latter reaction is rapid at temp. >800° with any catalyst, but slightly hydrated or acid-sol. Al_2O_3 is an efficient catalyst between 250° and 500°. C. R. H.

Directional catalytic activity of a single crystal of copper. A. T. GWATHMEY and A. F. BENTON (J. Chem. Physics, 1940, **8**, 569—570).—A single crystal of Cu in the form of a sphere (A., 1940, I, 123) was heated in a glass tube through which passed a mixture of H_2 and O_2 (3 : 1) at a fixed rate. The temp. of the air adjacent to the tube was measured. At ~200° the surface of the Cu assumed a slight pink tint, at ~260° green and red areas formed a striking pattern, whilst at 300° the pattern became irregular and disappeared, apparently on account of reduction. At ~360° the surface atoms rearranged themselves and the catalytic activity was greatly increased. After heating at 540° for 1 hr. the surface showed smooth, shiny circular and elliptical areas at the (111) and (110) pole positions, whilst the remainder of the surface had a frosty appearance. The patterns produced by light reflected from the surface are discussed. A freshly polished single crystal of Cu was heated at 450° in a C_2H_4–H_2 mixture (1 : 1) but no appreciable reaction occurred, and no patterns or preferred crystal planes were developed. A crystal heated at ~400° in C_2H_4 showed highly-coloured patterns but no preferred facets. It is concluded that (i) catalytic union of H_2 and O_2 can occur on the microscopically plane surface of a Cu single crystal; (ii) the reaction renders the Cu surface sufficiently mobile to develop preferred crystal facets; (iii) the development of preferred facets and of appreciable catalytic activity occurs at approx. the same temp., suggesting that enhanced catalytic activity may be related to the development of facets. W. R. A.

Intermediate states in phase transformations and the catalytic influence of foreign gases on these. G. F. HÜTTIG (Angew. Chem., 1940, **53**, 35—39; cf. A., 1940, I, 126, 136).—After finely-divided α-Al_2O_3 has been heated in air to various temp., its properties, especially solubility in HCl, indicate that, in addition to the bulk recrystallisation which occurs at ~850°, there is a surface recrystallisation occurring at ~220°. Similarly, in a transition from an unstable to a stable phase (anatase–rutile, γ-Al_2O_3–α-Al_2O_3) it is necessary to distinguish between the bulk transformation and an incipient surface transformation occurring at a lower temp. Hence in such a transition there are in all six temp. regions to be distinguished, viz., those of surface and of bulk recrystallisation for each phase, and of surface and of bulk transformation. The data for Al_2O_3 and for TiO_2 suggest that the bulk transformation from unstable to stable occurs only when the bulk-recrystallisation temp. of the stable modification has been exceeded. The influence of a gas may be to facilitate the preliminary "loosening" of the lattice, and so accelerate a transformation, but it may also stabilise the loosened condition, and so retard the recrystallisation of the new phase. F. J. G.

Hydrogenation of ethylene at surfaces of certain oxides. I. Zinc oxide and zinc chromite. J. F. WOODMAN and H. S. TAYLOR. **II. Molybdenum oxide compounds.** J. F. WOODMAN, H. S. TAYLOR, and J. TURKEVICH (J. Amer. Chem. Soc., 1940, **62**, 1393—1396, 1397—1399).—I. ZnO and $ZnCr_2O_4$ act as catalysts for hydrogenation of C_2H_4, causing reaction with measurable velocity at room temp. Over certain pressure ranges the velocity of reaction on ZnO at 56° is independent of the partial pressures of H_2, C_2H_4, and C_2H_6. The activity of ZnO decreases gradually owing to the deposition of some substance on the active centres, probably through the polymerisation or decomp. of C_2H_4 on the surface. This deposit can be removed by heating in air at $\nless$150°, followed by prolonged heating in a vac. at

450°. Prolonged heating in air decreases the activity, probably owing to adsorption of O_2. At ≮218° the H_2–C_2H_4 mixture, or H_2 alone, reduces ZnO to Zn. C_2H_4 polymerises slowly on ZnO at 218° without appreciable formation of permanent gases. At 445° the polymerisation is rapid, but is accompanied by the formation of H_2 and CH_4. Small amounts of H_2O vapour poison the surface of ZnO completely at 56—400°.

II. The products obtained by heating NH_4 phosphomolybdate or NH_4 paramolybdate in air at 300°, followed by treatment with H_2 at 300°, show negligible activity as catalysts for the hydrogenation of C_2H_4 at <256°, but the product obtained by decomp. and reduction of NH_4 Ni molybdate at 300° catalyses the reaction at −80°. Magnetic susceptibility measurements and the observation that the catalyst is very readily poisoned by H_2S indicate that the action may be due to highly dispersed Ni.

J. W. S.

Catalytic hydrolysis of chlorobenzene in the vapour phase. A. A. VERNON and F. X. THOMPSON (J. Physical Chem., 1940, **44**, 727—730).—Of a no. of catalysts examined for use in the hydrolysis of PhCl in the vapour phase, the most efficient are Cu_2Cl_2, $Cu(NO_3)_2$, and $SnVO_3$ on SiO_2 gel and Al_2O_3. Hydrolysis occurs only over the range 400—575°. The yield is favoured by an increase in the H_2O : PhCl ratio and by low space velocities of PhCl.

C. R. H.

(A) **Catalytic decomposition of oxalic acid by colloidal platinum.** (B) **Effect of gases on the catalytic decomposition of oxalic acid by colloidal platinum.** I. SANO (Bull. Chem. Soc. Japan, 1940, **15**, 196—204, 204—206; cf. A., 1939, I, 377).—(A) 0·10, 0·05, and 0·025N-$H_2C_2O_4$ solutions have been oxidised in O_2 in diffused daylight with black Pt carbonyl sols for 30 hr. at 50°. The reaction, which is unimol. after a short transition period, is scarcely influenced by the concn. of the reacting solution. It proceeds thus: $H_2C_2O_4 + O_2 = 2CO_2 + H_2O_2$; $H_2O_2 = H_2O + O$; $O + H_2C_2O_4 = 2CO_2 + H_2O$. The last two reactions are rapid so that the velocity of decomp. is determined by the first reaction.

(B) The effect of O_2, N_2, and air under reduced pressure on the decomp. was examined; only O_2 produced marked acceleration. D. F. R.

Production of sulphur and aluminium sulphate in presence of [selenium] catalyst.—See B., 1940, 601.

Siderite as a catalyst for ammonia synthesis.—See B., 1940, 600.

Catalytic synthesis of *iso*butyl alcohol.—See B., 1940, 591.

Free radicals and radical stability. Influence of short-lived and long-lived radicals on the reactivity of alcohols.—See A., 1940, I, 305.

Electrolytic deposition of iron from silicate melts. W. GELLER (Z. Elektrochem., 1940, **46**, 277—278).—The presence of Fe•• ions in silicate melts has been confirmed by the deposition of Fe on the cathode in electrolysis. F. J. G.

Cathode phenomena in the electrolysis of aqueous solutions of alkali salts or hydroxides. II. R. PIONTELLI (Gazzetta, 1940, **70**, 167—169; cf. A., 1939, I, 424).—A further discussion of the mechanism of the cathodic evolution of H and of the depolarising action of secondary processes in the electrolysis of solutions containing alkali cations.

O. J. W.

Cerate oxidimetry. Electrolytic oxidation of cerium without the use of a diaphragm cell. G. F. SMITH, G. FRANK, and A. E. KOTT (Ind. Eng. Chem. [Anal.], 1940, **12**, 268—269).—The conditions under which $Ce_2(SO_4)_3$, $Ce(NO_3)_3$, and $Ce(ClO_4)_3$ can be oxidised electrolytically without the use of a diaphragm cell to form the acids $H_2Ce(SO_4)_3$, $H_2Ce(NO_3)_6$, and $H_2Ce(ClO_4)_6$ are described. Anode materials may be Pt, PbO_2, or graphite, and cathodes can be of Pt or Pb. Data showing the effect of variations in anode and cathode c.d. and the potential employed on the current efficiency and the extent of oxidation are recorded. The cerate-ion concept proposed formerly (A., 1938, I, 325, 471) is substantiated. L. S. T.

Etching of platinum metals and their alloys by alternating-current electrolysis.—See B., 1940, 614.

Electrolytic films in acid copper-plating baths.—See B., 1940, 616.

Influence of organic compounds on electrolytic nickel-plating.—See B., 1940, 617.

Effect of an oxide film of aluminium on the formation of an active layer.—See B., 1940, 621.

Photochemical sensitisation. M. BODENSTEIN (Naturwiss., 1940, **28**, 145—152).—A review.

A. J. M.

Optical sensitising of silver halides by dyes. S. E. SHEPPARD, R. H. LAMBERT, and R. D. WALKER (Nature, 1940, **145**, 969—970; cf. A., 1940, I, 193, 258).—The conditions necessary for a dye to act as an optical sensitiser of Ag halide appear to be (i) planar configuration of the dye mol., (ii) oriented edge-on adsorption, orthogonal to a (110) plane of crystal, and (iii) electronic transition in the dye ion on absorption of a photon polarised in an azimuth defined by (i) and (ii). L. S. T.

Low-intensity reciprocity law failure in photographic exposure. J. H. WEBB and C. H. EVANS (Phot. J., 1940, **80**, 188—192).—Tests with successive exposures to high-intensity (H) and low-intensity (L) light, applied to a plate in that order, or the reverse, the total energy in each pair of tests being the same, show that higher densities are always obtained with H applied first; if H provides about half or more of the total energy, and is applied first, the subsequent L is as efficient as H, and reciprocity failure is absent. It is therefore suggested that reciprocity failure is due to regression of a latent image speck in its initial stages, and that a speck can exist which is stable, but not yet developable; a primary H exposure can build up the stable state, and subsequent L is then as efficient as H. It would further seem that at the stable stage, the speck is half its final size, this applying only to grains

responsible for reciprocity failure; the latter may be grains in which the Ag_2S speck contains no Ag initially. Some results are given to show that a preliminary exposure at optimal intensity may assist in the recording of weak images in astronomy and spectroscopy. J. L.

Mercury-photosensitised hydrogenation of ethylene, propylene, and *n*-butylene. W. J. MOORE, jun., and H. S. TAYLOR (J. Chem. Physics, 1940, **8**, 504—505).—An olefine at about 40 mm. is mixed with a six-fold excess of H_2 and illuminated by 2537 A. Hg radiation. The products are analysed. From C_2H_4 predominantly C_4H_{10} is formed (84%) with C_2H_6 14% and CH_4 2%. With C_3H_6 64% of C_6H_{14} and 26% of C_3H_8 are the chief products, whereas with C_4H_8 the products are mainly C_8H_{18} (66%) and C_4H_{10} (29%). It is suggested that C_3H_6 and C_4H_8 form respectively Pr^{α} and Pr^{β} and Bu^{α} and Bu^{β} radicals. W. R. A.

Photolysis of methyl ethyl ketone. W. J. MOORE, jun., and H. S. TAYLOR (J. Chem. Physics, 1940, **8**, 466—467).—The photolysis of COMeEt by Hg radiation has been investigated from 90° to 200° and the products have been analysed. At the lowest temp. a small amount of diketone was found. Some polymeride, with an odour resembling that of mesityl oxide, was formed at all temp. but not in sufficient amount to be analysed. At low temp. the amount of C_3H_8 is > those of C_2H_6 and C_4H_{10} but at 200° the important products are CH_4 and C_2H_6. A free radical mechanism is advanced. W. R. A.

Photogalvanic effect. I. Photochemical properties of the thionine–iron system. II. Photogalvanic properties of the thionine–iron system. E. RABINOWITCH (J. Chem. Physics, 1940, **8**, 551—559, 560—566).—I. Solutions of thionine (I) and Fe^{II} salts are bleached on illumination but become coloured again in the dark. The kinetics of this reaction have been investigated from photometric measurements of the concn. of dye in the photostationary state, for which equations in terms of initial concn. and light intensity have been derived. At low concns. of (I) the bleaching $\propto$ light intensity and inversely $\propto$ [$Fe^{\cdots}$], but reaches a max. at a certain concn. of (I) and then decreases inversely as concn. of (I). The bleaching increases with increasing acidity. Mechanisms are put forward and quantum yields and velocity coeffs. are estimated.

II. The oxidation–reduction system thionine–Fe^{II} forms a sensitive photogalvanic cell in which the illuminated half-cell is negative with respect to the non-illuminated half-cell. Vals. of the photogalvanic potential with respect to composition and light intensity have been determined. The mechanism of the photogalvanic effect is discussed for weakly and strongly bleached solutions. For the latter the electrode potential is maintained by the transference of electrons from the semithionine ions to the electrode and of electrons from the electrode to the $Fe^{\cdots}$ ions; $Fe^{\cdot\cdot}$ and leucothionine ions are practically inactive. W. R. A.

Photochemical investigations. V. Photolysis and iodine-sensitised decomposition of gaseous ethylene iodide. W. H. JANNECK and E. O. WIIG (J. Amer. Chem. Soc., 1940, **62**, 1877—1878).—The rate of decomp. of gaseous $(CH_2I)_2$ at 80° is markedly increased on irradiation, and the reaction is sensitised by I. F. J. G.

Interaction of OH radicals and of similar free radicals. J. WEISS (Trans. Faraday Soc., 1940, **36**, 856—862).—The mode of interaction between free radicals is largely influenced by their possession of a permanent dipole, in the absence of which recombination often occurs (*e.g.*, $2Me \rightarrow C_2H_6$ by collision with a third body), whereas the presence of permanent dipoles favours dismutation. The interaction of OH is discussed in detail; the evidence as a whole indicates that the main reaction is $2OH \rightarrow H_2O + O$, and that the H_2O_2 formed is not due to recombination. Dismutation also occurs in the reaction between NHPh radicals formed by irradiating dissolved $(NHPh)_2$ with ultra-violet light; the final products are NH_2Ph and $(NPh\colon)_2$, which are formed with a quantum efficiency <1. F. L. U.

Photolysis of acetaldehyde. C. J. DANBY (Nature, 1940, **145**, 940).—In the photolysis of MeCHO at 300°, the rate of decomp. measured by chemical analysis for MeCHO at various stages agrees exactly with the pressure changes observed. No appreciable polymerisation occurs under these conditions (cf. A., 1940, I, 170). L. S. T.

Effect of ultrasonic waves on colloidal phenomena. VII. Effect on sucrose solutions. N. SATA and Y. HARISAKI (Bull. Chem. Soc. Japan, 1940, **15**, 180—185; cf. A., 1939, I, 369, 521).—It is shown by optical measurements and by iodometric analysis with and without Fehling's solution that inversion of sucrose is not effected by exposure to ultrasonic waves of 450,000 Hz. for periods up to 60 min. D. F. R.

Propagation of supersonics in liquids. E. G. RICHARDSON (Proc. Physical Soc., 1940, **52**, 480—488).—Using a hot-wire amplitude detector, the propagation and attenuation consts. of supersonic radiation in the range 200—1110 kc. per sec. in H_2O, hexane, CCl_4, CS_2, and C_6H_6 were determined. No dispersion of velocity was found, and attenuation consts., though > on classical theory, show no excessive abnormalities. N. M. B.

Effect of electric fields on the decomposition of nitrous oxide by α-rays. A. D. KOLUMBAN and H. ESSEX (J. Chem. Physics, 1940, **8**, 450—454).—The ion yields at 30° and 100° have been measured with no field, at half saturation, and at full saturation and it is concluded that, with no field, 9% of the reaction is initiated by combination of ions at 30° and 4% at 100°. At high field strengths an increase in ion yield is obtained probably on account of collisions between electrons and mols. but not started by ionisation. Therefore, electron collisions without ionisation should initiate part of the reaction occurring in the absence of electric fields. W. R. A.

Acid–base reactions in non-protonic solvents. J. P. MCREYNOLDS (J. Chem. Educ., 1940, **17**, 116—119).—A review. L. S. T.

Action of chlorine on hydroxides of lithium and potassium in presence of iodine. I. R. K.

BAHL and S. SINGH (J. Indian Chem. Soc., 1940, **17**, 167—168).—Passage of Cl_2 through a boiling solution of I in aq. LiOH yields $Li_8I_2O_{11},2H_2O$. KOH under similar conditions gives KIO_4. F. L. U.

Preparation of rongalite.—See B., 1940, 591.

Oxidation of metals and the formation of protective films. N. F. MOTT (Nature, 1940, **145**, 996—1000).—A lecture. L. S. T.

Corrosion of copper by sodium halide solutions. F. J. ASSELIN and F. A. ROHRMAN (Ind. Eng. Chem., 1940, **32**, 1015—1016).—The corrosion of Cu by halide solutions depends on the conductivity and on the O_2 content of the solution. Conductivity increases with rise in temp. and with increase in halide concn. On the other hand, O_2 content decreases under these conditions. With rise in temp. or with increase in concn. corrosion will tend to increase and then decrease as a result of these opposing factors. Data supporting this view are presented. C. R. H.

Formation of tungstates of barium, strontium, calcium, and lead as a function of p_H. R. BERKEM (Compt. rend., 1940, **210**, 731—733).—Tungstates with the following W : M ratios are pptd. on addition of aq. MCl_2 to boiling aq. $Na_2WO_4,2H_2O$ containing acid or alkali: M = Ba, 1 : 1, 2 : 1, 7 : 3, 5 : 2, 3 : 1, 4 : 1; Sr or Ca, 1 : 1, 2 : 1, 8 : 3, 3 : 1; Pb, 1 : 1, (PbO,WO_3). Each tungstate is formed within stated p_H limits, the W : M ratio increasing as p_H falls. A. J. E. W.

Preparation of pure alumina from Manchurian clay. IX. Preparation of the crystalline hydrate of aluminium hydroxide. T. ARIMORI (J. Soc. Chem. Ind., Japan, 1940, **43**, 145B).—Cryst. Al_2O_3 hydrate having the same diffraction pattern as böhmite (γ-Al_2O_3,H_2O) is obtained by neutralising a conc. solution of an Al salt with gaseous NH_3 under pressure at $\not<120°$. Using $Al_2(SO_4)_3$ solutions, $[Al_2O_3]$ should be >7 wt.-%. With NH_4 alum, solutions containing >9 wt.-% of Al_2O_3 could not be used as NH_3 absorption is slow owing to the formation of large amounts of $(NH_4)_2SO_4$. Settling rates and the amount of absorbed H_2O for the ppts. are $<$ those for ppts. obtained by neutralisation by aq. NH_3, as also is $[SO_3]$ (1% of wt. of Al_2O_3). I. C. R.

Preparation of anhydrous aluminium bromide. P. K. WINTER and P. L. CRAMER (Ind. Eng. Chem., 1940, **32**, 856—857).—Br is introduced near the bottom of a reaction vessel, filled with Al chips or pellets, through an inclined tube. After initiation by heating, the reaction supplies sufficient heat to vaporise the Br, so that it reacts with Al in the vapour phase, and to distil the $AlBr_3$. Temp. is controlled by the $AlBr_3$ refluxing over the metal in the flask. The $AlBr_3$ passes to a distilling flask filled with Al chips (for removing Br) whence it is distilled continuously into storage flasks. A 1-l. reaction flask can produce 1 kg. of $AlBr_3$ per hr. I. C. R.

Gallium chlorides. A. W. LAUBENGAYER and F. B. SCHIRMER (J. Amer. Chem. Soc., 1940, **62**, 1578—1583).—The v.p. and v.d. of $GaCl_3$ have been determined at 50—200° and 117—498°, respectively. No association appears to occur beyond Ga_2Cl_6, which is 3·44 and 88·26% dissociated at 205·5° and 498·3°, respectively. $GaCl_3$ has m.p. 77·0°, b.p. 200·0°, its latent heat of vaporisation at the b.p. being 11·4 kg.-cal. per mol. and its latent heats of vaporisation and sublimation at the m.p. being 11·8 and 17·0 kg.-cal. per mol., respectively. *$GaCl_2$* has been prepared by heating $GaCl_3$ with excess of Ga in a vac. during 1 hr. at 175°, the product being distilled off at 225° and freed from the more volatile $GaCl_3$ by heating at 160°. It forms colourless crystals, m.p. 170·5±0·5°, which are deliquescent in air. It is decomposed into $GaCl_3$ and Ga at an appreciable rate at $>200°$. V.d. measurements at 400—470° indicate that the vapour contains some $GaCl_2$, in which Ga has the anomalous valency of 2. No evidence of the formation of GaCl was obtained. J. W. S.

Concentration of ^{13}C. C. A. HUTCHISON, D. W. STEWART, and H. C. UREY (J. Chem. Physics, 1940, **8**, 532—537).—Using gas-liquid exchange reactions and either fractionating columns packed with glass spirals or Pegram columns, attempts to concentrate ^{13}C have been made. No concn. of ^{13}C was produced in the exchange between gaseous NH_2Me and aq. NH_2Me,HCl. In the reactions between gaseous HCN and aq. HCN or aq. NaCN the increases in $[^{13}C]$ are 0·9- and 6·7-fold, respectively. A method (described) for producing 2·5 g. per day of NaCN containing C of 25 at.-% ^{13}C has been developed. W. R. A.

Separation of isotopes by chemical means. H. C. UREY (J. Washington Acad. Sci., 1940, **30**, 277—294).—A lecture. The various methods of separating isotopes are compared, the theory of separation by fractional distillation being discussed in detail. Similar theory applies to the chemical concn. of isotopes by exchange reactions when these reactions are carried out in a two-phase system by counter-current methods. The use of such methods in the concn. of N, C, S, Li, and K isotopes is summarised. The economic and other advantages of the chemical methods are discussed. The use of a centrifugal fractionating column appears to offer the most promising method for the separation of isotopes of high at. wt., to which existing methods are not applicable. J. W. S.

Corrosion-resistance of metals to nitric acid.—See B., 1940, 616.

Reduction of Nb_2O_5 to Nb_2O by means of hydrogen. O. KUBASCHEWSKI (Z. Elektrochem., 1940, **46**, 284—287; cf. A., 1940, I, 265).—It is confirmed that Nb_2O_5 may be reduced to Nb_2O by pure dry H_2. F. J. G.

Nature of the thiocyanate complex of molybdenum. C. F. HISKEY and V. W. MELOCHE (J. Amer. Chem. Soc., 1940, **62**, 1565—1574).—The reaction between KCNS and Mo^V is reversible, the effects of salts on the equilibrium being attributed to changes in the apparent activities of the various components owing to salting out and salting in effects. The ratio KCNS : Mo is always 3. The changes in the colour of the complex with increasing acid concn. are also discussed. J. W. S.

Physico-chemical separation of isomeric atoms. L. IMRE (Naturwiss., 1940, **28**, 158).—A method of separating isomeric atoms depending on

their distribution between the surface of a crystal and its saturated solution is described. The method has been used for the separation of the isomeric $^{80}_{35}Br$ nuclei with half-lives 18 min. and 4·5 hr., AgCl being used as the crystal. The activity of the crystal and the solution was determined and indicated that separation had been effected. The method is applicable in many cases. A. J. M.

Surface interaction between ferric and magnesium oxides. H. R. THIRSK and E. J. WHITMORE (Trans. Faraday Soc., 1940, **36**, 862—863).—Fe_2O_3 vapour condensed on to heated cryst. MgO gives rise to a compound, apparently MgO,Fe_2O_3, having a spinel structure (cf. A., 1940, I, 266), oriented parallel to the MgO lattice, and exhibiting slight twinning on octahedral planes. F. L. U.

Electrochemical methods in microchemistry. E. B. ASHCRAFT (Trans. Electrochem. Soc., 1940, **78**, Preprint 9, 127—137).—A review of recent literature. D. F. R.

Theory of chromatography. J. N. WILSON (J. Amer. Chem. Soc., 1940, **62**, 1583—1591).—A theory of chromatographic analysis is based on the assumption that equilibrium between the solution and adsorbent is established instantaneously, and that the effects of diffusion can be neglected. The theory accounts qualitatively for separations possible by the chromatographic method, the uniformity of colour in the adsorption bands, and the sharpness of the edges of the bands. J. W. S.

Scheme for qualitative analysis employing spot tests. W. C. DAVIES (J. Chem. Educ., 1940, **17**, 231—233).—The commoner cations are separated into the usual groups, and then identified by the direct application of drop reactions. L. S. T.

Measuring p_H in alkaline cyanide plating baths.—See B., 1940, 617.

Determination of free acid in aluminium sulphate, alum cake, etc.—See B., 1940, 601.

Gas analysis with the "contact candle": determination of hydrogen.—See B., 1940, 583.

Fluorescence analysis. III. Fluorescence-adsorption indicators. H. GOTÔ (Sci. Rep. Tohôku, 1940, **28**, 513—527; cf. A., 1940, I, 267).—Titrations of 0·1 and 0·02N-NaCl with $AgNO_3$ have been studied in aq. solution and in presence of MeOH, EtOH, and $COMe_2$, with or without dextrin as a protective colloid, using fluorescein, eosin, umbelliferone, β-naphtholsulphonic acid, β-$C_{10}H_7$·OH, phloxin, or dichlorofluorescein as fluorescent indicator. Generally good results are obtained in the absence of org. solvent or in presence of MeOH, but EtOH and $COMe_2$ tend to obscure the end-point. Dextrin seems apt to interfere with the adsorption of the dye, but a good end-point can be obtained by its use when adsorption is too rapid and powerful. J. W. S.

Assay for iodine and iodide in iodine solutions.—See B., 1940, 639.

Determination of small amounts of fluorine in water. O. J. WALKER and G. R. FINDLAY (Canad. J. Res., 1940, **18**, **B**, 151—159; cf. A., 1937, III, 391).—The effects of other constituents on the colorimetric and the titration methods for determining small amounts of F have been studied, and modified procedures are described. The titration method is trustworthy when distillation with $HClO_4$ instead of with H_2SO_4 is used. The colorimetric method fails in presence of >2 p.p.m. of PO_4''', Al···, or Fe···, or of >120 p.p.m. of SO_4''. Correction for the last is possible. F. J. G.

Determination of oxygen in lead and lead alloys.—See B., 1940, 613.

Determination of dissolved oxygen in gasoline.—See B., 1940, 585.

Determination of sulphate by the tetrahydroxyquinone method. Effect of sodium sulphite and procedure for its elimination. H. L. KAHLER (Ind. Eng. Chem. [Anal.], 1940, **12**, 266—267).—The presence of residual SO_3'' in feed and boiler waters interferes with this method, giving high results; ~80—90% of the SO_3'' is titrated. SO_3'' can be eliminated satisfactorily by adding 0·5N-HCl and boiling for 2 min. Optimum conditions for the method are laid down. L. S. T.

Systematic detection of thiocyanate, iodide, bromide, and chloride. D. HART and R. MEYROWITZ (Ind. Eng. Chem. [Anal.], 1940, **12**, 318—320).—Procedures for detecting 1 mg. each of CNS′, I′, Cl′, and 2 mg. of Br′ in 3 ml. of solution in the Na_2CO_3 extract of a mixture, without the use of Ag· as a group reagent, are described. In the final tests Fe··· is used for CNS′, H_2O_2 to liberate I which is extracted with CCl_4, $KMnO_4$ to liberate Br, and Ag· to detect Cl′. Methods for the removal of $Fe(CN)_6'''$, $Fe(CN)_6''''$, CN′, S″, AsO_3''', S_2O_3'', SO_3'', C_2O_4'', and tartrate, which interfere with the procedures, are detailed. L. S. T.

Field determination of carbon disulphide in air.—See B., 1940, 644.

Volumetric determination of selenate. G. C. SOTH and J. E. RICCI (Ind. Eng. Chem. [Anal.], 1940, **12**, 328—329).—The simplified method described for the distillation of SeO_4'' with HBr avoids the use of a current of CO_2, the possibility of reduction to Se, the danger of incomplete absorption of Br by KI, and the difficulty of determining when the distillation is finished. L. S. T.

Effect of ferric sulphate in shortening Kjeldahl digestion. F. M. STUBBLEFIELD and E. E. DETURK (Ind. Eng. Chem. [Anal.], 1940, **12**, 396—399).—The four procedures proposed by Gerritz and St. John (A., 1936, 219), and seven new modifications have been compared with the official Kjeldahl–Gunning–Arnold method, using lucerne as test material. The Gerritz–St. John procedures give low results. Electric heaters giving an intense heat over a wide surface of the flask shorten markedly the digestion time in the official method. A similar effect is obtained in the usual Bunsen burner digestion by adding $Fe_2(SO_4)_3$. Bumping during the distillation is eliminated by using K_2HPO_4 in the digestion. Hg is more rapid than Cu as catalyst, and is essential to the method proposed. For a 2-g. sample of plant material, with 25 ml. of H_2SO_4,

0·6 g. of Hg, 10 g. of anhyd. K_2HPO_4, and 6 g. of $Fe_2(SO_4)_6$, the digestion time is reduced from 2·5 to 0·5 hr. KH_2PO_4 or NaH_2PO_4 are less satisfactory than K_2HPO_4. Data comparing the new with the official method are recorded for a wide range of materials. L. S. T.

Nitrite-nitrogen standards. W. F. Reindollar (Ind. Eng. Chem. [Anal.], 1940, **12**, 325).—Merck's reagent grade $NaNO_2$ contained 99·4% $NaNO_2$ after drying overnight in a desiccator, and provided a satisfactory standard for nitrite-N in the Griess–Ilosvay method. When $AgNO_2$–NaCl is used, clarification of the solution by decantation is preferable to that by filtration. L. S. T.

Potentiometric studies in oxidation–reduction reactions. VIII, IX. Oxidation with chloramine-*T*. B. Singh and A. Rehmann (J. Indian Chem. Soc., 1940, **17**, 169—172, 173—176).—VIII. With bright Pt as an electrode chloramine-*T* can be used for the quant. potentiometric titration of quinol, quinhydrone, N_2H_4, KI, $NaHSO_3$, and $NaNO_2$.

IX. KIO_3, $KMnO_4$, $K_2Cr_2O_7$, and K_2CrO_4 can be determined indirectly by adding a measured excess of KI and titrating the unused portion potentiometrically against chloramine-*T*. F. L. U.

Determination of nitrogen in plain and alloyed steels.—See B., 1940, 611.

Interferometric assay of nitrous oxide.—See B., 1940, 601.

Phosphate separation in qualitative analysis. J. N. Friend, R. H. Vallance, and H. J. G. Challis (Nature, 1940, **146**, 63).—PO_4''' is removed before pptn. of group IIIa by addition of an acid solution of $Zr(NO_3)_4$. Al is always present in commercial ZrO_2 and Zr salts, and must be removed from the $Zr(NO_3)_4$ by boiling with excess of NaOH, washing, and dissolution of the ZrO_2,nH_2O in HNO_3 (1 : 1). L. S. T.

Removal of phosphates from solutions of hydrogen peroxide. S. R. Dickman and R. H. Bray (Ind. Eng. Chem. [Anal.], 1940, **12**, 279).—The addition of 10 ml. of 2% $FeCl_3$ and 5 g. of $CaCO_3$ to 100 ml. of H_2O_2, and rapid filtration, removes PO_4''' with little loss of activity of the H_2O_2. L. S. T.

Permanganimetric titration in alkaline solutions. I. Volumetric determination of formic acid, arsenious acid, manganese, and thallium. II. Direct titration of selenious and tellurous acids. III. Volumetric titration of formaldehyde and thiosulphate. H. Katô (Sci. Rep. Tôhoku, 1940, **28**, 570—579, 580—584, 585—587).—I. 0·1N-$KMnO_4$, saturated with Ag_2SO_4 (to coagulate the MnO_2 produced), can be used for the titration of HCO_2H, As_2O_3, Mn¨, and Tl˙ in solutions made alkaline by addition of excess of K_2CO_3. The $KMnO_4$–Ag_2SO_4 keeps satisfactorily for 1 month, but shows detectable change in concn. after 6 months.

II. 0·1N-$KMnO_4$, ~0·04M. in $ZnSO_4$ (to coagulate the MnO_2), can be used for the titration of H_2SeO_3 and H_2TeO_3 in presence of an excess of K_2CO_3. Results obtained in the determination of H_2SeO_3 by addition of $KMnO_4$ in acid solution and back titration with $H_2C_2O_4$ are low, as H_2SeO_4 is reduced slightly by an excess of $H_2C_2O_4$, whilst in the corresponding determination of H_2TeO_3 the results are high, as the $KMnO_4$ is decomposed to a slight extent in presence of H_2SO_4.

III. 0·1N-$KMnO_4$ containing $ZnSO_4$ can be used for the titration of $Na_2S_2O_3$ and CH_2O in presence of an excess of K_2CO_3. Oxidation occurs to Na_2SO_4 and CO_3'', respectively. J. W. S.

Rapid determination of quartz in felspar. G. H. McIntyre and M. Bozsin (Ind. Eng. Chem. [Anal.], 1940, **12**, 326—328).—Fusion buttons are prepared, pulverised, and examined with polarised light. The quartz grains remain unfused, and appear light or coloured against the dark glass. They are counted and comparison with prepared standards is made. L. S. T.

Silicomolybdate method for silica. H. W. Knudson, C. Juday, and V. W. Meloche (Ind. Eng. Chem. [Anal.], 1940, **12**, 270—273).—The effect of molybdate concn., p_H, and time on the development of the yellow colour in the Dienert–Wandenbulcke colorimetric method has been investigated. 2 ml. of 10% NH_4 molybdate per 100 ml. of sample are satisfactory for 50 p.p.m. of SiO_2; a large excess is to be avoided as the colour is then less stable. With 5 p.p.m. of SiO_2, the p_H range for max. development of colour is 1·6—2·0; with higher concns. this range can be broadened. Addition of free acid is preferable to that of a buffer. The use of buffered K_2CrO_4 (cf. A., 1934, 1194) is recommended. The Cenco and Evelyn photo-electric colorimeters are both suitable for this determination, and give an accuracy of ~1% with 1 p.p.m. of SiO_2. Careful selection of filters by means of a spectrophotometer is essential. The improved method is suitable for determining small changes in concn. of low quantities of dissolved SiO_2 in natural waters. L. S. T.

Correcting ignited silica precipitates for non-volatile material. J. S. Billheimer, P. H. Faust, and E. H. Swift (Ind. Eng. Chem. [Anal.], 1940, **12**, 409—411).—Evaporation of ignited Al_2O_3 or TiO_2 with HF followed by treatment with $H_2C_2O_4$ and ignition (cf. B., 1932, 147) results in loss, but no significant loss occurs with a mixture of HF and H_2SO_4. Evaporation with HF + $HClO_4$, followed by heating with $H_2C_2O_4$, and ignition, is satisfactory for all but the most accurate work. Decomp. of the fluorides is complete, and attack on the Pt from decomp. of the perchlorates is prevented by the $H_2C_2O_4$. Under the conditions prescribed, no explosions have occurred with the org. matter and $HClO_4$. The behaviour of CaO, Al_2O_3, TiO_2, and Fe_2O_3 on treatment with HF and other dicarboxylic acids is described. L. S. T.

Rapid determination of silicon [in iron and steel].—See B., 1940, 611.

Detection of carbon monoxide in medicinal oxygen.—See B., 1940, 639.

Extraction of alkalis in rocks. Modification of the J. Lawrence Smith extraction, using barium chloride as a flux. R. E. Stevens (Ind. Eng. Chem. [Anal.], 1940, **12**, 413—415).—1 g. of

$BaCl_2,2H_2O$ is substituted for 0·5 g. of NH_4Cl in the usual method. The preliminary slow heating to remove NH_3 becomes unnecessary, and SO_4'' is automatically removed. Comparisons of the two methods on five different rocks are recorded. The $BaCl_2$ method can be used advantageously in the analysis of alunites as the formation of a fused mass is avoided, and the sintered cake is easily removed from the crucible and disintegrated in H_2O. Neither method is affected by a high Mg content in the sample.
L. S. T.

Determination of minute amounts of potassium. Iodometric evaluation of the cobaltinitrite precipitate, using ceric sulphate. I. A. KAYE (Ind. Eng. Chem. [Anal.], 1940, **12**, 310—311).—The cobaltinitrite ppt. is dissolved in an excess of $Ce(SO_4)_2$, an excess of KI is added, and the liberated I titrated with 0·002N-$Na_2S_2O_3$ (starch). For 0·036—0·120 mg. of $K^{\cdot}$ the average error is +0·5%, for 0·030—0·02 mg., it is −3·5%, and for smaller amounts of K it increases to −20%. An empirical factor for calculating the % of K has to be determined. Details of procedure are given. L. S. T.

Determination of sodium in presence of other metals. E. C. ELLIOTT (Ind. Eng. Chem. [Anal.], 1940, **12**, 416—417).—The Mg UO_2 acetate method (A., 1931, 56) can be used for determining small amounts of $Na^{\cdot}$ in presence of $Be^{\cdot\cdot}$, $Ce^{\cdot\cdot\cdot\cdot}$, $La^{\cdot\cdot\cdot}$, $Nd^{\cdot\cdot\cdot}$, $Tl^{\cdot}$, $Th^{\cdot\cdot\cdot\cdot}$, $V_2O_2^{\cdot\cdot\cdot\cdot}$, and $Zr^{\cdot\cdot\cdot\cdot}$. SiO_2 is removed with HF and H_2SO_4. Nb and Ta form heavy, gelatinous ppts. with the reagent. Large, but not small, amounts of Sb also ppt. with the reagent, and interfere with the determination. L. S. T.

Photographic silver-gelatin paper as a reagent in drop analysis. G. SCHWARZ (Ind. Eng. Chem. [Anal.], 1940, **12**, 369—372).—Photographic paper developed to complete blackness becomes more brightly reflecting when dipped in hot H_2O. The brightening is prevented by all mercaptans (I) and seleno-alcohols (II), certain heterocyclic substances containing :NH, salts of Ag, Hg^{II}, I′ but not F′, Br′, Cl′, or S_2O_3'', and substances that easily eliminate Se or Te. (I) react in acid and alkaline media, but the heterocyclic substances generally only in alkaline solution. Many bivalent S-containing substances as well as disulphides formed by oxidation of (I), and diselenides from (II) give a positive, but less sensitive, reaction. Iminazoles react only weakly, and :CO *o*- to :NH interferes with the test. A drop of the test solution is placed on the dry paper (prep. described) and either allowed to evaporate or removed by means of filter-paper after 5 min. contact. The paper is dipped into H_2O at 70—90°, and the reaction is positive when the spot appears black against a grey background. The limiting concn. is ~1 in 10^5. Numerous org. compounds tested are listed.
L. S. T.

Determination of sub-micro-quantities of calcium. A. E. SOBEL and I. A. KAYE (Ind. Eng. Chem. [Anal.], 1940, **12**, 311).—A correction (cf. A., 1940, I, 232). L. S. T.

Quantitative spectrochemical analysis of dilute solutions. Safe alternating-current high-voltage arc circuit. A. E. RUEHLE and E. K. JAYCOX (Ind. Eng. Chem. [Anal.], 1940, **12**, 260—261).—The circuit with its tie-in with the ordinary d.c. arc and condensed spark circuits is described. The a.c. arc provides a reproducible source for determining Ba, Sr, Te, and P in dil. solutions. Using the comparison standard method, a precision of ±5—10% is attainable. L. S. T.

Quantitative spectrochemical analysis of important trace elements in mixed fertilisers.—See B., 1940, 632.

Quantitative separation of metals by hydrogen sulphide. VI. Quantitative separation of iron from manganese by hydrogen sulphide. VII. Quantitative separation of zinc from chromium and separation of chromium from nickel, cobalt, and iron. VIII. Separating aluminium from iron, nickel, and cobalt. IX. Precipitating range of cadmium sulphide and the separation of cadmium from zinc. X. Activity product and the complete precipitation range of lead sulphide. XI. Activity product and the complete precipitation range of bismuth sulphide. H. KATO (Sci. Rep. Tôhoku, 1940, **23**, 528—533, 534—539, 540—543, 544—555, 556—563, 564—569).—VI. Fe can be separated quantitatively from Mn if a NaOAc–AcOH buffer solution of p_H 5·1 is added to the nearly neutral and unbuffered solution of the metals, and the resulting solution is saturated with H_2S.

VII, VIII. See A., 1935, 719, 1474.

IX. From determinations of the $[Cd^{\cdot\cdot}]$ in HCl solutions of various concns. after saturation of $CdCl_2$–HCl solutions with H_2S, it is found that the activity product of CdS at 25° is 5·1 × 10^{-30}. From this val. and the corresponding val. for ZnS (4·5 × 10^{-24}) it is inferred that separation of Zn and Cd by H_2S is unsafe in HCl, although separation may be possible in many cases in 0·4N-acid, whereas in H_2SO_4 separation is most efficient in 3·5—4·0N-acid.

X. From investigations of the $[Pb^{\cdot\cdot}]$ necessary to cause the pptn. of PbS from various solutions of HCl saturated with H_2S, it is found that the activity product of PbS at 25° is 4·3 × 10^{-30}. Curves are given showing the complete pptn. range of PbS, and it is inferred that the quant. separation of Pb from Zn by H_2S is generally impossible. By combining the results with other thermodynamic data it is inferred that the single electrode potential of S, E^0_{298} $(S/S^{\cdot\cdot})$ = 0·51 v.

XI. The activity coeff. of $BiCl_3$ at various ionic strengths has been calc., and from investigations of the pptn. of Bi_2S_3 from solutions of various $[H^{\cdot}]$ the activity product of Bi_2S_3 is found to be 1·9 × 10^{-89} at 25°. Curves are given showing the complete pptn. range of Bi_2S_3, and it is inferred that quant. separation of Bi from Zn can be obtained with H_2S in 0·9—1·0N-HCl. J. W. S.

Induced precipitation in chemical analysis. I. H. KATÔ (Sci. Rep. Tôhoku, 1940, **90**, 588—594).—Induced pptns. are classified into cases due to compound formation, solid solution formation, and adsorption. The induced pptn. of $Zn(OH)_2$ by MnO_2 is attributed to compound formation, whereas the induced pptn. of FeS by ZnS is due to adsorption.

In the case of the self-induced pptn. of NiS and CoS it is supposed that the unstable modification is adsorbed on the stable form, and is there converted into the stable form (cf. A., 1938, I, 472). J. W. S.

Colorimetric determination of lead chromate by diphenylcarbazide. Determination of lead in blood etc.—See A., 1940, III, 780.

Rapid volumetric analysis of lead–tin–antimony alloys.—See B., 1940, 613.

Colorimetric micro-determination of copper. I. NUMATA and D. MATSUKAWA (J. Biochem. Japan, 1939, **30**, 395—399).—The Fischer–Leopoldi method (A., 1934, 381) is applied to the determination of 1—6 μg. of Cu. F. O. H.

Precision of the micro-electrolytic determination of copper. W. M. MACNIVEN and R. A. BOURNIQUE (Ind. Eng. Chem. [Anal.], 1940, **12**, 431—433).—The magnitudes of the precision of each operation in the micro-electrolytic determination of Cu from pure solutions have been determined, and expressed in terms of the average deviations of a series of observations. The predominating error is in the weighing, and particularly in the reproducibility of the rest-point. Errors of handling the wts. and cathode, of cleaning and drying the cathode, and of sampling by aliquots (5 ml. from 250 ml.) are of less significance. The precision with which Cu can be deposited is slightly greater in the Clarke–Hermance (A., 1932, 492) than in the Pregl cell. With the former apparatus, 1—2 mg. of Cu can be determined with a precision of $\pm0{\cdot}010$ to $\pm0{\cdot}012$ mg. for a series of determinations. Errors in depositing Cu are insignificant by comparison with the sum of all the other errors. L. S. T.

Colorimetric micro-determination of copper in ampoules of iron, arsenic, and copper [preparations].—See B., 1940, 639.

Determination of calomel in tablets.—See B., 1940, 639.

Cerate oxidimetry. Preparation and stability of solutions. G. F. SMITH and C. A. GETZ (Ind. Eng. Chem. [Anal.], 1940, **12**, 339—340; cf. A., 1940, I, 367).—The stabilities of 18 solutions of $Ce(NO_3)_6''$ and $Ce(ClO_4)_6''$ in different concns. of HNO_3 and $HClO_4$ under varied conditions for periods up to 246 days are recorded. Solutions stored in diffused daylight show a small, but detectable, photochemical decomp. HNO_3 and $HClO_4$ solutions (1—3M.) of $(NH_4)_2Ce(NO_3)_6$ (I) are the most stable. $HClO_4$ solutions of $H_2Ce(ClO_4)_6$ require standardisation at frequent intervals. The stability of all solutions increases with time as the $Ce^{\cdot\cdot\cdot}$ accumulates in the system. 5—10% of other rare earths of the Ce group do not affect stability adversely. 0·1N. solutions of commercial (I) in N-$HClO_4$ are sufficiently stable in ordinary light for 20 days not to require restandardisation. The most stable solution is given by purified (I) in 2N-$HClO_4$; the change in normality during ten days' storage is 1 in 10^4. L. S. T.

Patent-blue V as a p_H and redox indicator. J. H. YOE and G. R. BOYD, jun. (Ind. Eng. Chem. [Anal.], 1940, **12**, 399).—A correction (cf. A., 1939, I, 577). In titrations with $Ce(SO_4)_2$, using Patent-blue V, a satisfactory end-point is not obtained when a phosphate "preventive solution" is employed. L. S. T.

Determination of indium by micro-methods. G. L. ROYER (Ind. Eng. Chem. [Anal.], 1940, **12**, 439—440).—A micro-method for determining In by deposition on Pt in the Clarke–Hermance cell (A., 1932, 492) from an electrolyte of aq. $H_2C_2O_4$ made alkaline to Me-orange with aq. NH_3 is described. Pptn. by 8-hydroxyquinoline in NH_4OAc buffer and weighing as $In(C_9H_6ON)_3$ is also detailed. Application to a synthetic mixture of the composition of a sphalerite is given in illustration of the electrolytic method. L. S. T.

Formaldoxime colorimetric method for [determining] manganese. C. P. SIDERIS (Ind. Eng. Chem. [Anal.], 1940, **12**, 307; cf. A., 1939, III, 222).—Interference by $Fe^{\cdot\cdot\cdot}$ and PO_4''' in biological material is eliminated by neutralising the HCl solution of the ash with NaOH, acidifying with AcOH, adding $Pb(OAc)_2$ to remove excess of PO_4''', and Na_2SO_4 to remove excess of Pb before developing the colour with formaldoxime reagent. Addition of NaCN as recommended previously (B., 1937, 1383) is unnecessary. In a 10-ml. sample containing 0·005—0·01 mg. of Mn in presence of 0·010—0·100 mg. of PO_4''', the average error of the method is 2%. L. S. T.

Solution method for spectrographic analysis utilising a dropping electrode. R. J. KEIRS and D. T. ENGLIS (Ind. Eng. Chem. [Anal.], 1940, **12**, 275—276).—A standard solution of the ion under investigation is dropped slowly and regularly through a hollow upper C electrode, suitably drilled, on to the flat surface of a lower C rod electrode. Test data for solutions containing $Mn^{\cdot\cdot}$ and $Cu^{\cdot\cdot}$, as internal standard, are recorded. L. S. T.

Determination of iron in lubricating oils.—See B., 1940, 586.

Rapid analysis of steel.—See B., 1940, 611.

Spectro-analytical determination of very small amounts of iron in ultra-pure aluminium.—See B., 1940, 615.

Spectral analysis for remelt (light) alloys.—See B., 1940, 615.

Photometric determination of cobalt in steels.—See B., 1940, 611.

Use of thiocarbamide for determination of bismuth in refined tin and lead.—See B., 1940, 613.

Determination of gold in cyanide solutions.—See B., 1940, 614.

Laboratory [heating] torch. J. M. KRAPPE (J. Chem. Educ., 1940, **17**, 216—219).—The construction and uses of a torch suitable for heating glass or metal are described. Needle-point to large flames can be obtained with either gas and air or gas, air, and O_2 mixtures. L. S. T.

Device for controlling the temperature of absorption cells. D. WILLIAMS and R. TASCHEK (Physical Rev., 1938, [ii], **53**, 851).—The arrangement

described controls the temp. of small cells to 0·1° in the range 25—160°. L. S. T.

Thermometer for low temperatures. A. FARKAS and L. FARKAS (Ind. Eng. Chem. [Anal.], 1940, **12**, 296).—The v.p. thermometer described is suitable for use in a limited space. When filled with suitable gases above the Hg a no. of such thermometers will cover the range 5° to −215°. L. S. T.

Two-colour optical pyrometer. H. W. RUSSELL, C. F. LUCKS, and L. G. TURNBULL (J. Opt. Soc. Amer., 1940, **30**, 248—250).—A direct-vision portable and an automatically recording form of two-colour photo-electric optical pyrometer are described. They obviate the failure of the monochromatic instrument if the emissivity of the source or the transmission of the intervening space is unknown or variable. Readings are accurate to ~10°. N. M. B.

Microscope hot stage for determination of m.p. Application to carotenoid pigments. F. P. ZSCHEILE and J. W. WHITE, jun. (Ind. Eng. Chem. [Anal.], 1940, **12**, 436—438).—In the apparatus described the m.p. of a single crystal, surrounded by an inert atm. and heated electrically, is observed as a sharp change in the transmission of polarised light. The temp. range is from room temp. to 250° and the precision 0·02°. The m.p. of α- and β-carotene in an atm. of N_2 are 184·45° and 179·80°± 0·02°, respectively. Owing to oxidation, the m.p. in air are 1—3° lower, and in O_2, ~11° lower, than in N_2. L. S. T.

Carbon arc as a radiation standard. H. G. MACPHERSON (J. Opt. Soc. Amer., 1940, **30**, 189—194).—The characteristics of a C arc for certain special uses and the factors affecting the operation of the arc for calibration of optical pyrometers are discussed. Spectral energy distribution was measured and its relation to arc temp. determination is deduced. The nature and connexion of distribution temp., colour temp., brightness temp., and true max. temp. are examined, and vals. of these are given for the standard pyrometric arc with 0·25-in. graphite anode and for the $\frac{5}{16}$-in. pure C anode. N. M. B.

High-power tungsten light source. H. BEUTLER and N. METROPOLIS (J. Opt. Soc. Amer., 1940, **30**, 115—117).—To obtain the highly increased intensity for ~λ 3400 by operating at ~3600° K., the lamp described employs a heavy W strip with monel leads to H_2O-cooled brass leads and an A atm. with ~150 amp. N. M. B.

Convenient light source for a ten-inch Wilson cloud chamber. W. M. POWELL (Physical Rev., 1938, [ii], **53**, 327). L. S. T.

Photoconducting alkali halide crystals and their use as spectral filters. W. R. S. GARTON (Proc. Physical Soc., 1940, **52**, 559—563).—An electron diffusion method is described for treating crystals (KCl, NaCl) to produce an absorption band or *F*-band, usually in the visible region, resulting in a coloration of the crystal. Such crystals become photoconducting when irradiated by light falling within the *F*-band, and can be used as spectral filters which transmit the whole or part of the ultra-violet, but absorb strongly in the visible. Data for this use are discussed. N. M. B.

Depth of focus of microscope objectives. D. G. BEADLE (Nature, 1940, **145**, 1018—1019).—Counts of fine dust particles show that present formulæ for the depths of focus of these objectives give vals. ≫ the experimental. L. S. T.

Vacuum interferometer for precise measurements. R. M. ELLIOTT (Rev. Sci. Instr., 1940, **11**, 235—236).—The considerable effect of variations of pressure and temp. in the use of the Fabry–Perot interferometer when the exposures are long is considered. A vac. interferometer in which these difficulties are overcome is described. A. J. M.

Absorption cells for dense liquids. H. E. BENT and C. A. KRINBILL (Rev. Sci. Instr., 1940, **11**, 237).—The construction of absorption cells for use with dark liquids which must not be exposed to the air is described. A. J. M.

Displacement polarimeter. N. UNDERWOOD (Physical Rev., 1938, [ii], **53**, 853).—Measurements accurate to 0·1° are obtained with the instrument described. L. S. T.

Intensity-scale monochromatic sensitometer. C. H. EVANS (J. Opt. Soc. Amer., 1940, **30**, 118—127).—A working model for the region 3500—11,000 A. is described. The radiation for exposure is obtained from a double monochromator employing transmission replica gratings as the dispersing elements, and intensity is measured with a thermopile. Intensity-scale exposures on the photographic material result from the use of a specially designed intermittent intensity-scale sector wheel. The exposure time is the same at all λλ, and hence the spectral sensitivity curve derived from the intensity-scale characteristic curves is independent of any reciprocity law failure of the emulsion. N. M. B.

New mounting for an industrial grating spectrograph. J. H. DOWELL (Proc. Physical Soc., 1940, **52**, 559).—The grating and plate are connected by levers so arranged that the correct position of the plate and grating is controlled by a single lever which is set to a scale giving the λ range which will be included on the plate for any given setting. N. M. B.

Design and calibration of an infra-red spectrometer with a fluorite prism. E. S. BARR (Physical Rev., 1938, [ii], **53**, 852).—An infra-red spectrometer of the Wadsworth type has been constructed for use with a 60° fluorite prism. L. S. T.

Integrating photometer for *X*-ray photograms. S. BEZZI (Gazzetta, 1940, **70**, 160—166).—A simple photo-electric photometer for determining the relative intensities of the interference rings of *X*-ray photograms is described and its application to the analysis of data for anthracene is illustrated. O. J. W.

Continuous source for Spekker photometer. H. H. DARBY (J. Amer. Chem. Soc., 1940, **62**, 1874—1875).—A H_2 discharge tube, suitable for use as a continuous source for the Spekker photometer, is described. F. J. G.

Precision spectrophotometer for use in the range 450 to 820 mμ. S. JACOBSOHN, H. E. BENT, and A. J. HARRISON (Rev. Sci. Instr., 1940, **11**, 220—226).—A photo-electric spectrophotometer is described. The absorption cells are illuminated with light which has passed through two monochromators, the half-intensity width of the spectral region isolated being from 5 to 10 mμ. Cells 20 cm. long and 14 cm. in diameter may be used. A sensitive null instrument is used as detector. A. J. M.

Electronic absorption photometer. J. B. H. KUPER (Physical Rev., 1938, [ii], **53**, 920). L. S. T.

Thermoelectric absorptiometer for analytical work. H. H. WILLARD and G. H. AYRES (Ind. Eng. Chem. [Anal.], 1940, **12**, 287—291).—The construction and operation of a portable thermoelectric absorptiometer are described. The instrument gives a direct reading to an accuracy of 0·1% light absorption. It can also be applied to colourless systems giving infra-red absorption. Test data are recorded for nine systems showing a wide range of visible colour and spectral absorption, and for a turbidimetric determination [Zn with $K_4Fe(CN)_6$]. L. S. T.

Simple *X*-ray shutter. O. J. BALTZER (Rev. Sci. Instr., 1940, **11**, 237).—A rotary *X*-ray shutter driven by a motor which will stop within a quarter of a revolution, even when a heavy Pb disc is attached, is described. The advantages of the shutter include constancy of exposure intervals and ease of calibration. A. J. M.

Diffraction maxima in *X*-ray photographs. W. H. ZACHARIASEN (Nature, 1940, **145**, 1019).—The effect described by Raman and Nilakantam (A., 1940, I, 286) is not new. A theory concerning it has been put forward previously (*ibid.*, 285). L. S. T.

Precision *X*-ray camera for high temperatures. C. NUSBAUM (Physical Rev., 1938, [ii], **53**, 918). L. S. T.

Flexible conductivity bridge assembly. W. F. LUDER and A. A. VERNON (J. Chem. Educ., 1940, **17**, 229—231). L. S. T.

Compact 750-kv. van de Graaff generator for high currents. J. B. FISK and I. A. GETTING (Physical Rev., 1938, [ii], **53**, 916).—The generator is suitable for use in nuclear physics. L. S. T.

600-kv. a.c. generator for the production of neutrons. T. R. FOLSOM (Physical Rev., 1938, [ii], **53**, 687).—Conventional *X*-ray transformers are cascaded to produce the necessary potential. L. S. T.

Hysteresis testing with cathode rays. C. T. RAZOR (Physical Rev., 1938, [ii], **53**, 851).—The usual type of cathode-ray oscillograph with electrostatic deflexion plates can be used to construct hysteresis loops of magnetic specimens or of the cores of completed machines. L. S. T.

Laboratory electric stirring motor. E. B. HERSHBERG (Ind. Eng. Chem. [Anal.], 1940, **12**, 293—296).—Details of construction and assembly of motor and pulley with controlled speed are given. The unit is suitable for driving wire stirrers. L. S. T.

Einthoven string galvanometer-amplifier system for the investigation of photovoltaic effects. W. VANSELOW, G. P. HAPP, J. RUSSELL, and S. E. SHEPPARD (Rev. Sci. Instr., 1940, **11**, 202—203).—The system has been used in the measurement of very short duration photo-potentials. D. F. R.

Use of the wave guide for measurement of microwave dielectric constants. H. R. L. LAMONT (Phil. Mag., 1940, [vii], **30**, 1—15).—Four methods of measurement of ϵ at λλ 15—25 cm., employing a cylinder of the dielectric as a wave guide, are described. ϵ has been determined by the methods described for liquid paraffin, paraffin wax, and polystyrene, giving vals. 2·19, 2·22, and 2·47 (±0·01), respectively. L. J. J.

Influence of external resistance in the cell circuit on the maxima in polarographic current–voltage curves. J. J. LINGANE (J. Amer. Chem. Soc., 1940, **62**, 1665—1669).—With increasing resistance in the cell circuit, the max. of the polarographic current–voltage curves are decreased. An explanation of the effect is based on the fact that the e.m.f. across the cell itself decreases during the life of each drop when there is a large resistance in series. F. J. G.

Erratic potentials of [platinum] electrodes sealed in glass tubing. A. B. GARRETT, E. HOGGE, and R. HEIKS (Science, 1940, **92**, 18).—Erratic behaviour of electrodes sealed in glass tubing is more prevalent than is generally realised. It is restricted to the region of the glass–metal–solution interface, and is eliminated by removing the glass tubing from the electrode, or by allowing only the wire to touch the solution being titrated or the electrolyte being investigated. L. S. T.

Glass electrodes. L. KRATZ (Z. Elektrochem., 1940, **46**, 259—264).—Bibliographical. F. J. G.

Construction and potential of glass electrode cells; sign, normalisation, and direct applicability of p_H scales. L. KRATZ (Z. Elektrochem., 1940, **46**, 253—259).—Various types of glass electrode cell are discussed, with special reference to the construction of a direct-reading p_H scale. F. J. G.

[Photo-electric] hydrogen sulphide detector. —See B., 1940, 601.

Photo-electric modifications of mercuric oxide in contact with an electrode. G. DÉCHÊNE (J. Phys. Radium, 1940, [viii], **1**, 112—120).—In an arrangement where HgO was packed between two electrodes, one of which was transparent, the high contact resistance of the transparent electrode was diminished by irradiation with white or ultra-violet light. This constitutes a new type of photo-electric cell and the photo-electric couple at the HgO measures the photo-electric e.m.f. The phenomena indicate a secondary photo-conductivity effect in a thin layer of HgO in contact with the electrode. W. R. A.

High-frequency systems for the cyclotron. J. R. DUNNING and H. L. ANDERSON (Physical Rev., 1938, [ii], **53**, 334).—Improved methods for feeding high-frequency energy to the accelerating electrodes

of the cyclotron have been developed. Increases in energy and intensity of the ion beam have resulted.
L. S. T.

Directional counter tube. W. DREBLOW and B. RAJEWSKY (Naturwiss., 1940, **28**, 92—93).—A counter tube for use in diagnosing Ra poisoning, which is sensitive, and will also indicate the position of the Ra source, is described. The counter is made of two different metals (Pb and Al), and depends on the asymmetry of the electron emission for entering and leaving radiation, which is accentuated by the use of the different metals. A. J. M.

Paralysis of sub-threshold counters. C. G. MONTGOMERY and D. D. MONTGOMERY (Rev. Sci. Instr., 1940, **11**, 237—238).—Care should be taken in using a sub-threshold Geiger counter to ensure either that the background radiation has no effect on the size of the larger pulses which it is desired to observe, or that the background is kept const. This is particularly necessary when the counter is used near a cyclotron. A. J. M.

Improvements in a Geiger–Müller counting system. H. MCMASTER and M. L. POOL (Rev. Sci., Instr., 1940, **11**, 196—198).—A new method of interpolation is described which eliminates one valve per scale-of-two and does not disturb the equilibrium of the trigger valves. A resolving time of 10^{-4} sec. was obtained with a quenching circuit incorporating the desirable features of both the Neher–Harper and the multivibrator circuits. D. F. R.

Geiger counter. T. G. HOW and K. LARK-HOROVITZ (Physical Rev., 1938, [ii], **53**, 334).—In the new form described the sample is placed in the counter. L. S. T.

Probable errors in counts from Geiger–Müller counters. E. RODGERS (Physical Rev., 1938, [ii], **53**, 850). L. S. T.

Operating characteristics of a cloud chamber designed for use through a range of pressures. F. N. D. KURIE (Physical Rev., 1938, [ii], **53**, 215).—The chamber is designed to operate at pressures ranging from the v.p. of the condensant to several atm. The sensitive time can be varied from ~0·5 sec., and the chamber can be operated 10 times a min.
L. S. T.

Practical applications of electronic control principles to the operation of a Wilson cloud chamber. I. I. HOPKINS, R. T. DICKERSON, and W. M. NIELSEN (Physical Rev., 1938, [ii], **53**, 850).—A circuit for the complete electronic control of a Wilson cloud chamber has been constructed. L. S. T.

Stereoscopic viewing and measuring instrument for cloud chamber photographs. C. JONES and A. RUARK (Physical Rev., 1938, [ii], **53**, 677).
L. S. T.

Universal electron microscope for light- and dark-field and stereoscopic operation. M. VON ARDENNE (Z. Physik, 1940, **115**, 339—368).—Complete constructional details are given, and the magnetic and electrostatic operation of the microscope are described; typical photomicrograms (magnification ≯200,000) are reproduced. The resolving powers with light and dark fields are 30 and 50 A., respectively; particles 10 A. in diameter can be detected. A. J. E. W.

Field emission microscope. M. BENJAMIN (J. Soc. Glass Tech., 1940, **24**, 93—96T).—The construction and use of a projection type electron microscope are briefly described. A fine point of the metal surface under examination is located at the centre of a spherical camera. The electrons emitted from the point under the influence of an electric field give a characteristic pattern on the hemispherical fluorescent screen by radial projection. J. A. S.

Present position regarding the development of the electron microscope. L. C. MARTIN (J. Soc. Glass Tech., 1940, **24**, 97—100T).—The various types of electron microscope are classified and the possible future developments are outlined. J. A. S.

Electron supermicroscope. M. VON ARDENNE (Naturwiss., 1940, **28**, 113—127).—Photographs of mols. of hæmocyanin, tobacco and tomato-mosaic virus, bacteria, crystals of MgO, surfaces of metals, etc. obtained with an electron supermicroscope are reproduced. A. J. M.

Mass spectrometer for routine isotope abundance measurements. A. O. NIER (Rev. Sci. Instr., 1940, **11**, 212—216).—A mass spectrometer, of which the feature is the comparatively small magnet used in the analyser, is described. It is suitable for routine isotope analyses of C, N, and other light elements which can be introduced in the form of gas or vapour. Results obtained in the determination of the relative abundance of ^{22}Ne and ^{20}Ne are given. A. J. M.

Radioactive standards. L. F. CURTISS, C. GOODMAN, A. F. KOVARIK, S. C. LIND, C. S. PIGGOT, and R. D. EVANS (Rev. Sci. Instr., 1940, **11**, 205).—A series of radioactive standards available at the National Bureau of Standards in Washington is described. It includes 100-c.c. solutions containing 10^{-9} and 10^{-11} g. Ra for emanation standards, 5-c.c. solutions containing from 0·1 to 100 μg. Ra for γ-ray standards, sublimed $ThCl_4$, and 12 rock samples, ground and analysed for Ra and Th content. D. F. R.

Sartorius–Ramberg micro-balance. J. KUCK and E. LOEWENSTEIN (J. Chem. Educ., 1940, **17**, 171—176).—The theory of the Ramberg quartz-stick rider as a solution for certain types of rider error is discussed. The latest design of Sartorius–Ramberg micro-balance is described and tests of its performance are recorded. L. S. T.

Differential temperature error in weighing. E. BLADE (Ind. Eng. Chem. [Anal.], 1940, **12**, 330—331).—Weighings of a specially-prepared steel plummet and a porcelain crucible of the usual type on a magnetically-damped balance show that a temp. difference between object and balance produces an error ∝ the magnitude of the difference and of opposite sign, which dissipates logarithmically with time. The highly-polished 17-g. plummet gave a max. error of 0·05 mg. per degree for differences up to 15° > or < the temp. of the balance; this error may persist for 30 min. The 16-g. crucible gave a max. error of 0·19 mg. per degree, but the effect

disappears more rapidly, usually in 15 min. The rest-point of a balance shifts temporarily when a warm or cold object is weighed. Convection currents mainly are responsible for the above errors.
L. S. T.

Realisation of very high pressures of from 50,000 to 100,000 kg. per sq. cm. J. Basset (J. Phys. Radium, 1940, [viii], **1**, 121—123).—Constructional details of apparatus are given. Pressures ≯75,000 kg. per sq. cm. are attained by means of pistons and cylinders of metallic carbides. The cylinders are made by jointing together flanged concentric tubes causing centripetal reactions to oppose the expansion of the cylinder due to pressure. Very low temp. must be employed to attain pressures >75,000 kg. per sq. cm. W. R. A.

Determination of elastic constants of isotropic solids by means of supersonic waves. R. Bär (Helv. Phys. Acta, 1940, **13**, 61—76).—A method depending on the diffraction of supersonic waves is described. A. J. M.

Mortar and pestle for powdering glass. H. L. Wunderly (Ind. Eng. Chem. [Anal.], 1940, **12**, 284).—An Fe rod with a screwed-on nut fits into a closed Fe pipe and forms the pounding surface.
L. S. T.

Field and laboratory micro-analysis by means of a portable drop reaction kit. P W. West and L. Smith (J. Chem. Educ., 1940, **17**, 139—145).—Portable apparatus and procedure for using well-known drop reactions in qual. analysis are described.
L. S. T.

Tube for nitrogen purification. A. B. Garrett and R. Heiks (Science, 1940, **91**, 460).—An Fe pipe, 24 × 2 in., is filled with Cu turnings, and heated electrically by means of Ni–Cr wire. The reduced ends of the tube are connected to $\frac{3}{8}$-in. Cu tubing. The purified gas is passed through alkaline pyrogallol, which removes the last traces of O_2 and indicates the efficiency of the tube. L. S. T.

Dry ice as a preventive of atmospheric oxidation. G. E. Ferguson and L. Scheflan (Ind. Eng. Chem. [Anal.], 1940, **12**, 276).—The use of solid CO_2 placed in the liquid and wash H_2O before the titration of $Sn^{\cdot\cdot}$ with I is described. L. S. T.

Mounting powdered samples for *X*-ray diffraction. J. Lukesh (Rev. Sci. Instr., 1940, **11**, 200—201).—The sample is made into a stiff paste with a binder and extruded from a brass nozzle, which also acts as a holder during photographing. Library paste is a suitable binder as the starch pattern seldom registers, but when it does, it may be easily recognised. D. F. R.

Inexpensive stirrer for large water-baths. A. Hemingway and W. B. Shelley (Rev. Sci. Instr., 1940, **11**, 204—205).—The stirrer consists of a vertical axle having three inclined circular vanes, mounted in a bicycle-wheel bearing, and rotating in a 3-in. diameter brass tube. The H_2O is circulated through openings in the top and bottom of the tube.
D. F. R.

Condensation-hygrometer. T. Okada and M. Tamura (Proc. Imp. Acad. Tokyo, 1940, **16**, 141—143).—Two Cu vessels containing, respectively, dry and moist air are connected by a U-tube manometer. The vessels are cooled and on condensation of H_2O from the moist air a pressure difference is indicated on the manometer. The humidity of the moist air is then obtained by adding this pressure difference to the saturation v.p. at the lower temp. D. F. R.

Inorganic chromatography. V. Inorganic chromatography as an auxiliary method in micro-analysis. G. M. Schwab and A. N. Ghosh (Angew. Chem., 1940, **53**, 39—40; cf. A., 1937, I, 150, 578).—The use of a narrow tube (1—2 mm.) much increases the sensitivity of chromatographic reactions. F. J. G.

Mercury-sealed vessels for storage of solutions. F. E. Holmes (Ind. Eng. Chem. [Anal.], 1940, **12**, 425—427).—Three types of Hg-sealed storage vessel with attached burette, and a Hg-sealed dropping bottle, are described and illustrated.
L. S. T.

Weighing flask for precision standardisation of strong alkalis in the absence of carbon dioxide. P. Nahinsky and H. A. Laitinen (Ind. Eng. Chem. [Anal.], 1940, **12**, 417).—An Erlenmeyer flask specially modified for use in effecting acid–base titrations in absence of CO_2 is described and illustrated. Procedure for determining the wt.-normality of acids or bases with a high degree of precision is described.
L. S. T.

Removal of sulphur from laboratory glassware. H. S. Wilson (Ind. Eng. Chem. [Anal.], 1940, **12**, 415).—H_2O is allowed to remain in the vessel for ≮ 1 day, and the removal accomplished with the aid of a knife or stirring rod as a reamer. In refractory cases, the S is heated and allowed to run down the sides of the vessel before the treatment with H_2O. L. S. T.

Construction and cooling of large vapour traps. D. L. Northrup, C. M. Van Atta, and L. C. Van Atta (Rev. Sci. Instr., 1940, **11**, 207—210).—A simple and efficient baffle system with a comparatively high conductance ratio, for use with a vapour trap, is described. The baffle plates are rectangular and are arranged in a helix. Two methods for maintaining the trap at —50° to —80°, one for intermittent and the other for continuous operation, are described. A. J. M.

Wettability of highly polished metal surfaces by graphite hydrosols. R. Szymanowitz and B. H. Porter (Rev. Sci. Instr., 1940, **11**, 230—231).—Polished surfaces which have been cleaned with metallographic powder and H_2O are freely wetted by pure H_2O, or graphite hydrosols at room temp. Surfaces that have not thus been cleaned can be successfully treated with colloidal graphite if they are first heated. There is a linear relationship between the concn. of aq. colloidal graphite and the min. temp. at which it will wet unclean, highly polished metallic surfaces. A. J. M.

Lining of metal capillaries with glass and the application to a capillary positive ion source. I. A. Getting and H. W. Leighton (Rev. Sci. Instr., 1940, **11**, 232—234).—A method is described for

lining metal capillaries with a coating of glass which may be as thin as 0·05 mm. This enables the advantages of a glass capillary for work on electrical discharge in gases to be retained, whilst the disadvantages of low thermal conductivity and low mechanical strength are largely removed. The use made of such a capillary in a highly efficient positive ion source for high-voltage nuclear research is described. A. J. M.

Filtering apparatus. J. F. KING and H. F. PRIEST (Ind. Eng. Chem. [Anal.], 1940, **12**, 418—419).—The device described and illustrated accelerates filtration, and permits the complete decantation of supernatant liquid without disturbing the settled ppt. L. S. T.

Simple hot filtrations and crystallisations. J. W. DAWSON and W. M. DEHN (Ind. Eng. Chem. [Anal.], 1940, **12**, 317).—An arrangement for avoiding crystallisation on the filter-paper and in the stem of the funnel is described. L. S. T.

Filter aids. A. L. OLSEN (Ind. Eng. Chem. [Anal.], 1940, **12**, 254).—An arrangement for surrounding a Büchner funnel with hot H_2O is described. L. S. T.

Jacketed receiver for vacuum distillation. J. B. CLOKE (Ind. Eng. Chem. [Anal.], 1940, **12**, 329).—The usual type of receiver is provided with a jacket for the circulation of iced H_2O. L. S. T.

Efficient low-holdup laboratory column. M. L. SELKER, R. E. BURK, and H. P. LANKELMA (Ind. Eng. Chem. [Anal.], 1940, **12**, 352—355).—Construction, operation, and efficiency of an all-glass, 5-ft. column with an efficiency of ~85 theoretical plates and a hold-up of ~5 c.c. at a reflux rate of 100 c.c. per hr. are described. Small vols. of hydrocarbon isomerides can be fractionated accurately. L. S. T.

Pressure regulator for vacuum distillation. M. S. NEWMAN (Ind. Eng. Chem. [Anal.], 1940, **12**, 274).—A gas washing bottle, partly filled with Et phthalate and fitted with a ground-in glass tap, serves to maintain a const. pressure in the range 1·5—16 mm. over distillations lasting 10 hr. L. S. T.

Lithium chloride and calcium chloride as dehydrating agents.—See B., 1940, 578.

Nomographs for correcting volumes of perfect gases. J. G. ROOF (Ind. Eng. Chem., 1940, **32**, 998—1000).—Directions are given for constructing two nomographs for correcting vols. of dry grass over small temp. ranges (~5°) and over any pressure range. C. R. H.

Lantern demonstration of a rotating-vibrating diatomic molecule. C. L. WILSON (J. Chem. Educ., 1940, **17**, 187—189).—A lantern slide which represents rotation, vibration, and rotation-vibration in unsymmetrical diat. mols. is described. L. S. T.

Alexander Mikhaĭlovich Butlerov. H. M. LEICESTER (J. Chem. Educ., 1940, **17**, 203—209). L. S. T.

M. V. Lomonosov, 1711—1765. J. D. BERNAL (Nature, 1940, **146**, 16—17). L. S. T.

Georges Urbain. G. CHAMPETIER and C. H. BOATNER (J. Chem. Educ., 1940, **17**, 103—109). L. S. T.

Geochemistry.

Ozone clouds. F. W. P. GÖTZ (Helv. Phys. Acta, 1940, **13**, 3—5).—The daily variation of the height of the O_3 layer in the atm. has been investigated. The irregularities differ considerably from day to day. A. J. M.

Comparison of the densities of water from different places on the earth. K. GOTO and K. OKABE (Bull. Chem. Soc. Japan, 1940, **15**, 76—81).—Purified samples of H_2O from a large no. of widely separated places agree in ρ within $\pm$0·5 µg. F. J. G.

Zinc content of the hot springs of Japan. K. KURODA (Bull. Chem. Soc. Japan, 1940, **15**, 88—92).—Details are given of the polarographic determination of Zn in natural waters. Japanese waters contain on the average ~100 µg. of Zn per l., sea-H_2O <10 µg. per l. F. J. G.

Lead content of the hot springs of Japan. K. KURODA (Bull. Chem. Soc. Japan, 1940, **15**, 153—155).—Japanese hot springs contain on the average 22 µg. of Pb per l. as against ~2·4 µg. per l. in sea-H_2O. F. J. G.

Effect of rain on the composition of the hot springs of Yunohanazawa, Hakone. K. KURODA (Bull. Chem. Soc. Japan, 1940, **15**, 156—160).—Analytical and rainfall data are correlated. F. J. G.

Connecticut lake sediments. II. Chemical analyses of a core from Linsley Pond, North Branford. G. E. HUTCHINSON and A. WOLLACK (Amer. J. Sci., 1940, **238**, 493—517).—Chemical analyses of samples from 13 levels of a profile taken in sediments below the deep H_2O of a small eutrophic lake are tabulated. The significance of certain variations in the distribution of inorg. and org. constituents throughout the profile is discussed. L. S. T.

Thermoluminescence of some common and unusual minerals. M. A. NORTHUP and O. I. LEE (J. Opt. Soc. Amer., 1940, **30**, 206—223).—Qual. visually observed data are tabulated for the type and character of luminescence for 112 minerals of 32 species, including calcite and fluorite from a large no. of localities, and apatites, lepidolites, and felspars. Relation to triboluminescence, effect of heating to redness, and influence of activating impurities are discussed. General characteristics are classified, but results indciate that there is no simple relation between thermo- and the other forms of luminescence. N. M. B

Some constituents of meteorite rusts. J. D. BUDDHUE (Amer. Min., 1940, **25**, 435—437).—Evidence for the presence of magnetite, trevorite, zaratite, lawrencite, and vivianite in meteorite rusts is discussed. A chemical analysis [G. D. VAN

ARSDALE] of the oxide of the Xiquipilco, Mexico, meteorite is recorded. L. S. T.

New physical method for the determination of geologic ages. C. GOODMAN and R. D. EVANS (Physical Rev., 1938, [ii], **53**, 916).—Determination of the rate of He production in igneous rocks by direct counting of the α-rays has been combined with measurements of the He accumulated in a rock specimen during geological time to give an abs., physical method for measuring ages $\not> \sim 4 \times 10^8$ years. Comparison of the new method with the Rn–thoron–He method has disclosed an error of $\sim$130% in the Ra standardisation used in previous He age measurements, and established the absence of any strong unknown natural α-ray emission in igneous rocks. L. S. T.

Nature of the ore-forming fluid. L. C. GRATON (Econ. Geol., 1940, **35**, 197—358).—A review of present knowledge and theory as to the origin, state, composition, and effects of the mobile medium that transports mineral-forming materials from the magma, and deposits them to form the hypogene epigenetic ores. Successive events and conditions from magma to surface are discussed. Evidence supporting the acid gas and alkaline liquid hypotheses of transport is examined critically, and it is concluded that gaseous transport of ore materials from the magma is insignificant quantitatively, and that transport by a hot alkaline liquid is the dominant agent of hypogene ore genesis. L. S. T.

Theory of mineral sequence in hypogene ore deposits. I, II. M. C. BANDY (Econ. Geol., 1940, **35**, 359—381, 546—570).—In the average simple hypogene ore deposit, ore minerals are deposited in a regular sequence that can be predicted. The theory that progressive change in the ratio of the wt.-% of the anion to the cation is the fundamental control of sequence in deposition is advanced. Evidence that oxide minerals are deposited in an "ideal" or "normal sequence" such that each mineral has a larger wt.-% of anion than the preceding older mineral is given. Sulphides are deposited after oxides, with each younger sulphide having a smaller wt.-% of anion than the preceding sulphide. Textures as a means of determining age relationships are discussed, and actual sequences of various classes of ore deposits are compared with the theoretical "normal sequence." L. S. T.

Titaniferous ironsands of Patea [S. Taranaki], with an account of the heavy residues in the underlying sedimentary series. C. O. HUTTON (New Zealand J. Sci. Tech., 1940, **21**, 190—205B).—The occurrence of the ironsands and their mineral composition are described and discussed. The estimated amount of sand is $12{\cdot}25 \times 10^6$ tons. All samples contain Fe ore [magnetite (I)], pyroxenes, plagioclase, and hornblendes; minor amounts of quartz, zircon, apatite, and garnet are usually present. The Fe ore contains $\sim$10% TiO_2 present within the (I). The mineral compositions of the heavy residues from the two underlying formations are described. L. S. T.

Mineral notes from the Michigan iron country. V. L. AYRES (Amer. Min., 1940, **25**, 432—434).—Occurrences of stilpnomelane (chemical analysis given), halloysite, nontronite, and dihydrite from the Fe districts of Michigan are described. L. S. T.

Cryptocrystalline pyrite from Alpine Co., California. A. PABST (Amer. Min., 1940, **25**, 425—431).—The S deposit of the Leviathan mine is described. Chemical analyses, and the results of spectrographic and *X*-ray examinations of the peculiar varieties of pyrite that occur with this S, are recorded. L. S. T.

Hydrous iron sulphide in California crystalline limestone. J. D. LAUDERMILK and A. O. WOODFORD (Amer. Min., 1940, **25**, 418—424).—Occurrences of hydrotroilite as the pigmenting material of cryst. limestone at two southern Californian localities are described. Chemical analyses are recorded. L. S. T.

Geology of the chromite deposit of Jojohatu, Singhbhum. B. S. BHADAURIA (Quart. J. Geol. Min. Met. Soc. India, 1939, **11**, 123—133).—The results of microscopical examination of (i) the slates, slaty shales, and quartzite, (ii) the ultra-basic igneous rocks, consisting of pyroxenites, saxonites, dunites, serpentines, and associated talcose and cherty rocks, (iii) the granite, and (iv) the laterite with Fe predominating over Al are recorded. The chromite (I) occurs in veins or bands in the serpentinised ultrabasic rocks as boulder ore, Cr_2O_3 48—52%, reef ore, Cr_2O_3 48% after dressing, yellow reef ore, Cr_2O_3 50—52%, and lateritic ore, Cr_2O_3 35—40%. Mining and concn. methods are described, and serpentinisation and the origin of the (I) are discussed. L. S. T.

Metamorphic rocks in the Southern Konkan. K. V. KELKAR and W. P. PATANKAR (Quart. J. Geol. Min. Met. Soc. India, 1939, **11**, 109—111).—The occurrence of schists containing staurolite and kyanite is noted. L. S. T.

Geology of Tripura State, Bengal. K. L. DAS (Quart. J. Geol. Min. Met. Soc. India, 1939, **11**, 119—122).—Various sandstones, limestones, shales, laterites, and ferruginous concretions are mentioned. L. S. T.

Aurichalcite in Missouri. W. D. KELLER (Amer. Min., 1940, **25**, 375—376).—Aurichalcite, associated with sphalerite, hemimorphite, covellite, malachite, and dolomite, has been discovered in Newton Co., Missouri. L. S. T.

Montmorillonite in fuller's earth, Nutfield, Surrey. A. BRAMMALL and J. G. C. LEECH [with W. J. DUNSTALL] (Geol. Mag., 1940, **77**, 102—112).—Chemical analyses of fuller's earths, clay fractions and base-exchange derivatives are recorded and discussed. The constitution of montmorillonite in relation to base exchange is discussed. Dehydration curves for three clay fractions are given. L. S. T.

Microlite and stibiotantalite from Topsham, Maine. C. PALACHE and F. A. GONYER (Amer. Min., 1940, **25**, 411—417).—The occurrence of microlite, generally green in colour, in a topaz pegmatite at Topsham is described. ρ varies from 6·36 to 6·42 according to the H_2O content. The chemical

analysis recorded indicates a Ta-rich microlite with an unusually low H_2O content. L. S. T.

Structural scheme of attapulgite. W. F. BRADLEY (Amer. Min., 1940, **25**, 405—410; cf. A., 1938, I, 52; 1939, I, 346).—*X*-Ray diffraction patterns of centrifuged fractions of this clay, from Attapulgus, Georgia, are reproduced and discussed. An idealised structure, based on the cell $(OH_2)_4(OH)_2Mg_5Si_8O_{20},4H_2O$, is proposed. L. S. T.

Deposits of radioactive cerite near Jamestown, Colorado. E. N. GODDARD and J. J. GLASS (Amer. Min., 1940, **25**, 381—404).—Cerite occurs in small deposits in the Pre-Cambrian rocks of the Front Range near Jamestown, Colorado. The cerite rock, containing ~75% of cerite, occurs as irregular lenses in narrow aplite–pegmatite zones. Veinlets of black allanite (I) border the cerite rock, and grains of uraninite (II) and pyrite are present locally. The rock is intergrown with varying amounts of (I), brown epidote, törnebohmite, fluorite, bastnäsite, monazite, (II), and quartz. These minerals are described, and a chemical analysis [J. G. FAIRCHILD] of the rock, which contains 56% of rare-earth oxides, is recorded. An analysis for pure cerite is calc., and another [C. MILTON] for allanite from the southern cerite deposit is recorded. The age calc. from the Pb : U ratio is $9{\cdot}4 \times 10^8$ years. Comparisons with other deposits of cerite are made. L. S. T.

Iceland spar in [Taos Co.,] New Mexico. V. C. KELLEY (Amer. Min., 1940, **25**, 357—367).—The occurrence of the deposit is described (cf. A., 1940, I, 238). The most abundant type of calcite is white, the next most abundant is clear and colourless giving spar of optical grade, and the last type is pink. Mn (0·02%), or more probably Fe (0·01%), is responsible for the colour. The deposit is of hydrothermal origin. L. S. T.

Calcium carbonate deposits marginal to glaciers. J. C. LUDLUM (Science, 1940, **91**, 544—545).—Incrustations of $CaCO_3$ marginal to the Blackfeet glacier, Montana, are described, and the mechanism of their formation is discussed. L. S. T.

Occurrence of detrital diaspore in South Wales. J. C. GRIFFITHS and A. STUART (Geol. Mag., 1940, **77**, 74—76).—Sandy boulder clay from Ludchurch, Pembrokeshire, contains abundant grains of diaspore associated with numerous other minerals. L. S. T.

Basaltic lavas of South Kivu, Belgian Congo. A. HOLMES (Geol. Mag., 1940, **77**, 89—101).—Numerous chemical analyses are included. L. S. T.

Fluoborite from Selibin, Malaya. R. W. JOHNSTON and C. E. TILLEY (Geol. Mag., 1940, **77**, 141—144).—Fluoborite (I) (analysis given) is associated with phlogopite, tremolite, talc, fluorite, and dolomite (II), with arsenopyrite and cassiterite as the chief ore minerals, in the Beatrice Mine, Selibin. (I) may be produced by the direct action of B- and F-bearing vapours on (II). L. S. T.

Mineralogy of some Permian sediments from [Wandagee] Western Australia. H. G. HIGGINS and (MISS) D. CARROLL (Geol. Mag., 1940, **77**, 145—160).—Heavy mineral analyses are recorded. L. S. T.

Glauconite pseudomorphs after Ophiuran plates. C. T. BERRY (Science, 1940, **91**, 449).—Replacement of Ophiuran plates by glauconite at Grove Hill, Clarke Co., Alabama, is described. L. S. T.

Overite and montgomeryite: two new minerals from Fairfield, Utah. E. S. LARSEN, 3rd (Amer. Min., 1940, **25**, 315—326; cf. A., 1940, I, 240).—Overite, a_0 14·75, b_0 18·74, c_0 7·12 A. (all ±0·02 A.), v_0 1968 A.^{3}, unit cell $2[Ca_3Al_8(PO_4)_8(OH)_6,15H_2O]$, space-group *Bmam*, occurs in cavities in altered variscite. Montgomeryite, a new mineral from cavities in the variscite nodules of Fairfield, is monoclinic and occurs as green to colourless lath-shaped crystals; hardness 4, ρ 2·530±0·005, α 1·572, β 1·578, γ 1·582 (all ±0·002), $a : b : c$ 0·4145 : 1 : 0·2580, β 91° 34′ (morphological), a_0 9·99±0·02, b_0 24·10±0·02, c_0 6·25±0·05 A., β 91° 28′, v_0 1505 A.^{3}; space-group *C*2/*c*; unit cell $2[Ca_4Al_5(PO_4)_6(OH)_5,11H_2O]$. L. S. T.

Identification of the commoner tellurides. F. W. GALBRAITH (Amer. Min., 1940, **25**, 368—371).—Microchemical and etching tests for altaite, calaverite, coloradoite, hessite, krennerite, petzite, sylvanite, and Te are described. L. S. T.

Goldschmidtine identical with stephanite. M. A. PEACOCK (Amer. Min., 1940, **25**, 372—373).—Goldschmidtine (A., 1939, I, 498) is identical with stephanite, and the name must be withdrawn. L. S. T.

Stephanite morphology. E. D. TAYLOR (Amer. Min., 1940, **25**, 327—337).—The space-group is *Cmc*2 (cf. A., 1932, 904); a_0 7·70, b_0 12·32, c_0 8·48 (all ±0·05) A. L. S. T.

Theory of formation of vein gold deposits. O. E. ZVJAGINTZEV and I. A. PAULSEN (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 647—651).—The velocity of dissolution of Au in solutions of Na_2S saturated with H_2S increases to a max. with increasing concn. and then decreases to a very low val. at high concn., in accordance with the view that the effective agent is NaHS, whereas the very conc. solutions contain mainly Na_2S. The dissolution is facilitated by the presence of finely ground quartz or pyrites but is hindered by carbonates. The solubility increases markedly with rising temp. over the range 70—300°, so that the pptn. of Au does not require the presence of any particular mineral but is simply the result of cooling. F. J. G.

New copper-gold deposit in Tanganyika. J. DE LA V. POUSSIN (Bull. Acad. roy. Belg., 1939, [v], **25**, 279—288).—A description of the geology and characteristics of the deposits, their approx. composition with depth, and their dissimilarity from deposits of the same type in other localities. N. M. B.

Tschelkar [Ural] caustobiolith. P. I. SANIN (J. Appl. Chem. Russ., 1940, **13**, 244—254).—Analytical data are presented. The mineral appears to have originated from peat. R. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

OCTOBER, 1940.

New continuum in the spectrum of helium. A. G. Shenstone (Physical Rev., 1938, [ii], **53**, 941).—A continuum extending from the red to or beyond 2300 A. appears when a d.c. discharge of several amp. per sq. cm. is run in He at atm. pressure between H_2O-cooled electrodes. It has no obvious connexion with either the line or the band spectrum. L. S. T.

Effect of hyperfine structure on the magnetic rotation of the plane of maximum polarisation of resonance radiation. B. J. Miller (Physical Rev., 1940, [ii], **58**, 258—262).—Mathematical. An equation for the polarisation and the angle of max. polarisation of resonance radiation is developed and applied to the polarisation and angle for the line ${}^1S_0$—${}^1P_1$ for various vals. of the ratio of the hyperfine separation const. A to the natural breadth of the levels, for a nuclear moment of $\frac{1}{2}$. The polarisation and angle of max. polarisation for the Na D lines, for several vals. of the same ratio, are computed and compared with experiment. A range of possible vals. of A, showing some agreement with available data, was thus determined, and a val. found for the mean life agreeing well with that calc. from optical dispersion data. N. M. B.

Further description and classification of the spectrum of singly-ionised cerium. G. R. Harrison and W. E. Albertson (Physical Rev., 1938, [ii], **53**, 940—941).—The known lines of Ce II have been increased from 2800 to >6000 lines, and 12,000 lines of Ce I and Ce II between 8000 and 2400 A. have been photographed. The preliminary classification of Ce II (A., 1938, I, 108) has been extended to include ~2000 lines, and J vals. have been assigned to the levels concerned. Considerable interaction between the two electron configurations $4f5d6s$ and $4f5d^2$ is indicated. L. S. T.

Absorption of praseodymium ion in solutions and in the solid state. F. H. Spedding (Physical Rev., 1940, [ii], **58**, 255—257).—Assuming that in the solid and liquid phases the sharp absorption spectrum arises from transitions within the incomplete $4f$ shell, *i.e.*, from states arising from the f^2 configuration, the energy states of Pr IV are calc. and show good agreement with observed vals. N. M. B.

Extension of the analyses of the spectra of neutral osmium and iridium. W. Albertson (Physical Rev., 1938, [ii], **53**, 940; cf. A., 1938, I, 485).—New λ measurements for the arc spectra of Os and Ir have been made with a 35-ft. grating (30,000 lines per in.). 2169 of the 4500 lines for Os I and 1937 of the 3100 for Ir I have been classified as combinations between numerous energy states. The configuration interaction is pronounced, especially in Ir. The ionisation potential of Os I is 8·7 v. L. S. T.

Extension of the Bi I spectrum. H. E. Clearman, jun. (Physical Rev., 1938, [ii], **53**, 941).—Many new lines have been observed in this spectrum in the region 1350—2000 A. by a modification of Selwyn's method (A., 1929, 860). Several series have been traced. L. S. T.

Spectrum of doubly-ionised lead. M. F. Crawford, A. B. McLay, and A. M. Crooker (Physical Rev., 1938, [ii], **54**, 313).—The spectrum of Pb, excited by an electrodeless discharge in the vapour, has been measured in the region 800—10,000 A. Approx. 400 lines have been classified as transitions between 90 levels of the configurations given, and the classifications are consistent with the observed hyperfine structures of 64 of the lines. L. S. T.

***X*-Ray emission spectra and electronic energy bands of compounds.** J. Valasek (Physical Rev., 1940, [ii], **58**, 213—218; cf. A., 1938, I, 166).—Measurements of emission λλ in the $K\beta$ group of Ca and S in CaS and $CaSO_4$, of Mg and S in MgS, of S in SrS and BaS, and of Ca and Cl in $CaCl_2$ were made from the secondary radiation from pressed blocks of the salts. Determination of the origin of X-ray lines by means of electronic energy band systems is examined for CaS, MgS, and ZnS. The $K\beta_5$ line of Zn in ZnS and the $K\beta_1$ line of Mg in MgS are due to cross transitions from the outermost filled band of the negative ion. N. M. B.

Widths and relative intensities of *L*-series lines of the rare earth elements. C. H. Shaw (Physical Rev., 1938, [ii], **53**, 940).—The technique of forming X-ray targets of these metals suitable for ionisation intensity measurements has been worked out. The L-series lines of W have been measured and compared with those of Au. L. S. T.

Electric susceptibility in a magnetic field. N. Dallaporta (Nuovo Cim., 1936, **13**, 407—422; Chem. Zentr., 1937, i, 4070).—The dependence of electric susceptibility on the magnetic field strength is expressed by a coeff. of the form $S_0 + S_1/kT + S_2/k^2T^2 + S_3/k^3T^3$. Comparison is made with experimental data (Piékara and Schérer, A., 1935, 13, 1192), and discrepancies are discussed. A. J. E. W.

Characteristics of the copper arc in air. A. B. White (Physical Rev., 1938, [ii], **53**, 935—936).—The voltage characteristics of the atm. Cu arc have been recorded under various conditions of arc current, arc length, and electrode condition. Transition from

one form to another of the three forms of arc differentiated depends on conditions of temp. and oxide formation at the electrodes. L. S. T.

Variation of breakdown potential in hydrogen. W. Fucks and G. Schumacher (Naturwiss., 1940, **28**, 110).—The lowering of breakdown potential (ΔU) of a gas when the cathode is irradiated is given by $\Delta U/U = k\sqrt{i}$. For H_2, k varies with length of column and pressure. Explanations are considered. A. J. M.

Probe investigation of anode spots. J. E. Henderson and S. M. Rubens (Physical Rev., 1938, [ii], **54**, 238).—Symmetrical patterns of anode spots are readily produced in a glow discharge maintained in the space between two concentric Cu spheres of 53·4 and 5·08 cm. diameter, the inner sphere being the anode. Pressure, c.d., and surface conditions of the anode determine the no. and size of the spots (cf. A., 1930, 270). Similar conditions prevail when the inner sphere is replaced by a thin disc. Probe measurements indicate that the spots are sheaths possessing a positive space charge. L. S. T

Search for temperature changes accompanying field emission at high temperatures. G. Fleming and J. E. Henderson (Physical Rev., 1938, [ii], **54**, 241).—A former search for temp. changes of a field emitter (*ibid.*, 1935, [ii], **48**, 486) has been extended to the thermionic region using Au and Pt thermocouples, and W–Pt thermocouples as emitters. Even at temp. at which minute thermionic emission occurs the temp. change is $\not> 2°$. The results indicate that below the temp. at which this emission occurs strongly only a small fraction of the total no. of electrons emitted partakes of the thermal energy of the metals investigated. L. S. T.

Experiments and theory on the performance of the Geiger point counter. J. L. Bohn and J. Morgan (Physical Rev., 1938, [ii], **54**, 314).—Optimum conditions of performance have been investigated for various combinations of points, planes, and tubes. A modified form of Zeleny's theory explains the action of the counter. L. S. T.

Positive and neutral rays. V. Ionisation by collision of ions and atoms. A. Rostagni (Nuovo Cim., 1936, **13**, 389—406; Chem. Zentr., 1937, i, 3918—3919; cf. A., 1935, 274; 1936, 539, 1312).—A transverse-field apparatus for the study of collision ionisation in gases is described. Data are given for the effective cross-sections (A) of A, Ne, and He for ionisation by their own atoms or ions, with velocities (v) of 50—1100 v. As v increases A rises from a threshold val. which is approx. the same for atoms and ions of the same gas; the ratio of the A vals. for atoms and ions is also $\sim$1. A. J. E. W.

Ion optics of a five-section proton-accelerating tube. J. S. Allen and J. H. Williams (Physical Rev., 1938, [ii], **53**, 928).—Theoretical calculation, and experimental verification, of focal lengths of electrostatic lenses consisting of pairs of coaxial cylinders. L. S. T.

Reversible clean-up effect in low-pressure mercury-vapour discharges. C. Kenty (Physical Rev., 1938, [ii], **53**, 936).—In a steady positive-column discharge in Hg vapour at low pressures an equilibrium condition of clean-up exists at the walls, and a large exchange of Hg between the space and the walls takes place continually. Excited atoms, and gases other than Hg, are not involved. The effect is attributed to the penetration of ions to different depths into the surface. Hg is dislodged as well as cleaned up by ion bombardment, and the balance between these two effects determines mainly the equilibrium amount of Hg on the wall. A similar clean-up is found for an Fe surface. The effect has a considerable practical significance. L. S. T.

Nuclear magnetic moment of ^{13}C. R. H. Hay (Physical Rev., 1940, [ii], **58**, 180—181).—Using KCN and NaCN containing $\sim$22% abundance of ^{13}C, the mol. beam magnetic resonance method gave curves with a min. for which the g val. is 1·401$\pm$0·004. The sign of the nuclear magnetic moment, determined by the field reversal method, is positive. Evidence in favour of a spin of $\frac{1}{2}$ leads to a nuclear magnetic moment of 0·700$\pm$0·002 nuclear magneton. N. M. B.

Efficiency of γ-ray counters. F. Norling (Physical Rev., 1940, [ii], **58**, 277).—Comparative efficiency curves for γ-ray counters of brass, Al, and Pb are given and discussed. The Pb counter is very effective in the region of 0·5 Me.v. For Ra-C γ-rays filtered through 2·5 cm. Pb ($\sim$2 Me.v.) the relative efficiencies are Pb 100, brass 84$\pm$4, Al 109$\pm$4, and for unfiltered Ra γ-rays, Pb 100, brass 67$\pm$3, Al 75$\pm$3. The correlation of a γ-component to other particles, without use of an efficiency curve, by measuring the decrease of coincidence rate when absorbers are inserted in front of the γ-ray counter is examined for the case of ^{56*}Mn. N. M. B.

β-Radioactivity of rubidium. G. Occhialini (Ann. Acad. Brasil. Sci., 1940, **12**, 155—158).—Consideration of the results of Ollano (A., 1938, I, 56) shows that harder β-rays must be present corresponding with the recorded penetration of 6—7 $\times$ 10^{-3} cm. This is in agreement with the author's val. from the magnetic spectrograph (A., 1932, 138). F. R. G.

β-Ray spectrum of ^{128}I. R. H. Bacon, E. N. Grisewood and C. W. van der Merwe (Physical Rev., 1938, [ii], **54**, 315).—Measurements of this spectrum in a Wilson cloud chamber indicate the existence of two groups, with end-points at 2·1 and 1·05 Me.v., respectively. The group with the lower energy appears to be new. L. S. T.

Radioactive isotope of samarium. T. R. Wilkins and A. J. Dempster (Physical Rev., 1938, [ii], **54**, 315).—Combination of the mass spectrograph with the photographic emulsion track technique gives results that indicate the real half-life of ^{148}Sm to be 14% of the apparent half-life. L. S. T.

Cloud-chamber study of the α-rays of actino-uranium. T. R. Wilkins and D. P. Crawford (Physical Rev., 1938, [ii], **54**, 316).—The mean ranges of α-rays from U-I and U-II have been checked (cf. A., 1937, I, 388), and a residuum of α-rays, attributed to actino-U, has been confirmed. The

mean range of actino-U appears to be nearer that of U-II, and is probably 2·99 cm. in air at 15°.
L. S. T.

Dependence of neutron interaction with nuclei on neutron energy. P. N. Powers, H. H. Goldsmith, H. G. Beyer, and J. R. Dunning (Physical Rev., 1938, [ii], **53**, 947).—The dependence of neutron interaction on energy has been investigated for B, H, D, Fe, Au, and Ir by using a well-collimated beam of neutrons from a paraffin-surrounded source, which was kept at 295° or at 105° K. Total cross-sections for capture and scattering are recorded. L. S. T.

Dependence of magnetic scattering of neutrons on the magnetisation of iron. H. G. Beyer, H. Carroll, C. W. Witcher, and J. R. Dunning (Physical Rev., 1938, [ii], **53**, 947).—The variation in the magnetic scattering of neutrons with the intensity of magnetisation has been investigated by passing a well-collimated slow neutron beam through three Armco plates placed between the poles of a large electro-magnet. The increase in no. of neutrons transmitted through the magnetised Fe does not follow the magnetisation curve of the Fe. L. S. T.

Spin of the neutron. H. H. Goldsmith and L. Motz (Physical Rev., 1938, [ii], **53**, 947).—Consideration of the variation of the n–p scattering cross-section with neutron energy on both possible spin vals. of $\frac{1}{2}\hbar$ and $\frac{3}{2}\hbar$, and comparison of the predicted and experimental cross-sections at 2·5—3·0 Me.v., support the val. $\frac{1}{2}\hbar$ (cf. A., 1938, I, 115). L. S. T.

Absorption of slow neutrons by chlorine. E. O. Salant and W. J. Horvath (Physical Rev., 1938, [ii], **53**, 943).—Irradiation of CCl^4 with slow Ra–Be neutrons shows that the 35-min. period of Cl (Amaldi *et al.*, 1935, 910) is induced largely by C neutrons, and that the initial activity of Cl is small. Data for the absorption of neutrons of different energies by Cl are recorded and discussed. L. S. T.

Nuclear isomerism of ^{87}Sr. H. Reddemann (Naturwiss., 1940, **28**, 110).—Pure ^{87}Sr obtained from Canadian mica was irradiated with Ra–Be neutrons and with D + D neutrons. In both cases a β-activity was found, with half-life 3·0±0·1 hr., which is due to an unstable isomeride of ^{87}Sr. A. J. M.

Distribution in angle of protons from the deuteron–deuteron reaction. R. D. Huntoon, A. Ellett, D. S. Bayley, and J. A. Van Allen (Physical Rev., 1940, [ii], **58**, 97—102).—Using a special gas-target chamber and a bombarding energy range 60—390 ke.v., results are given by $N(\theta) = 1 + A\cos^2\theta$, where θ is the angle which the velocity of the proton makes with the direction of the deuteron beam as measured in the centre-of-mass co-ordinate system and $N(\theta)$ is the no. observed per unit solid angle at θ. The val. of A depends markedly on bombarding energy. N. M. B.

α-Particles from the disintegration of lithium by deuterons. H. Staub and W. E. Stephens (Physical Rev., 1938, [ii], **54**, 236).—The no.–range curve of α-particles arising from the disintegration of Li by deuterons at the 800-kv. peak has been obtained. The continuous distribution due to the reaction $^7Li + {}^2D \rightarrow {}^1n + {}^8Be$; $^8Be \rightarrow 2{}^4He$ was observed, ranging up to ~7·7 cm. Superimposed is a homogeneous group, agreeing in its 7·6 cm. mean range with that observed by Williams *et al.* (A., 1937, I, 593) and ascribed to the reaction $^7Li + {}^2D \rightarrow {}^4He + {}^5He$. This leaves the ^{5}He unstable by 0·8 Me.v. The peak at 7·6 cm. is wider than that observed at 13·0 cm., owing to the reaction $^6Li + {}^2D \rightarrow 2{}^4He$, which has a width of ~0·9 cm. at half-max. This width is due to the deep penetration of the deuterons at the high bombarding voltage of 0·8 Me.v. The nos. of disintegrations at 0·8 Me.v. for the three processes are in the ratio 50 : 10 : 1.
L. S. T.

Energy released in the reaction ^{6}Li (*p*, α) ^{3}He and the mass of ^{3}He. S. K. Allison, L. C. Miller, G. J. Perlow, L. S. Skaggs, and N. M. Smith, jun. (Physical Rev., 1940, [ii], **58**, 178).—The energy vals. obtained, using two methods of determination with variable-pressure absorption cells, were 3·95±0·06 and 3·94±0·05 Me.v. Computed masses based on H = 1·00813±0·00002, D = 2·01473±2, and ^{4}He = 4·00386±7 are ^{3}He = 3·01685±10, ^{6}Li = 6·01684±11, ^{7}Li = 7·01814±11, ^{8}Be = 8·00765±15, and ^{9}Be = 9·01484±13. N. M. B.

Energy released in the disintegration of ^{6}Li by protons. G. J. Perlow (Physical Rev., 1940, [ii], **58**, 218—225).—Using a high-dispersion arrangement of a small variable-air-pressure absorption cell and ionisation chamber, the energy release in the reaction ^{6}Li (*p*, α) ^{3}He was accurately determined by a comparison of the ^{4}He range with that of the α-particles from ^{9}Be (*p*, α) ^{6}Li. The val. found was 3·945±0·06 Me.v. compared with 3·72±0·08 found by Neuert (cf. A., 1935, 1297). With the new val., ^{3}H is unstable against β-decay by 0·19±0·09 or 0·10±0·1 Me.v., depending on the val. for the ^{2}D–^{4}He bracket. The ^{3}He mass is 3·01688±0·00011.
N. M. B.

Formation of ^{7}Be. R. B. Roberts and N. P. Heydenburg (Physical Rev., 1938, [ii], **53**, 929).—The range–no. curves of the α-particles emitted by B bombarded by 200-kv. protons show little evidence for the reaction $^{10}B + {}^1H \rightarrow {}^7Be + {}^4He + Q_1$. The energies of the neutrons emitted by ^{6}Li under deuteron bombardment indicate that ^{7}Be is formed according to $^6Li + {}^2H \rightarrow {}^7Be + {}^1n + Q_3$, and is converted into ^{7}Li only by K electron capture. L. S. T.

γ-Ray resonances from the bombardment of carbon by deuterons. W. E. Bennett and T. W. Bonner (Physical Rev., 1940, [ii], **58**, 183—185).—The excitation curve for the bombardment by 550—2000-ke.v. deuterons of thin C targets made by evaporation of paraffin on to Ag discs shows the first known case of resonant emission of γ-rays from deuteron bombardment. The resonances are at 920, 1160, 1300, 1430, and 1740 ke.v. The γ-rays are hard and show about the same absorption in Pb as do the γ-rays from RaTh. There is evidence that the reaction is $^{12}C + {}^2H \rightarrow ({}^{14*}N) \rightarrow {}^{14}N + \gamma_1 + Q$, where Q = 10·4 Me.v. N. M. B.

Resonances in the emission from the reaction ^{12}C + ^{2}H of (A) neutrons, (B) protons. T. W. Bonner, E. Hudspeth, and W. E. Bennett [(B) with M. M. Rogers] (Physical Rev., 1940, [ii], **58**, 185—

186, 186; cf. Amaldi, A., 1937, I, 438).—(A) The excitation curve for the emission of neutrons from a thin C target in the reaction $^{12}C + {}^{2}H \rightarrow ({}^{14*}N) \rightarrow {}^{14}N + {}^{1}n - 0{\cdot}25$ Me.v. shows resonances at 920, 1160, 1300, and 1825 ke.v. The neutrons were detected with a H_2-filled electroscope and results were checked by measurements of the radioactivity of ^{13}N. The curve is corr. for resonances due to the γ-rays from C (cf. preceding abstract), and the resonances found correspond with excited states of the ^{14}N nucleus at 11·19, 11·39, 11·51, and 11·96 Me.v.

(B) The excitation curve for the emission of 15-cm. protons from a thin C target in the reaction $^{12}C + {}^{2}H \rightarrow ({}^{14*}N) \rightarrow {}^{13}C + {}^{1}H + 2{\cdot}7$ Me.v. shows resonances at 920 and 1220 ke.v. The relative yield of protons to neutrons at 920 ke.v. is 1·9, indicating that the excited ^{14}N nucleus is about equally likely to break up into a proton or a neutron. It is possible that the resonances at 1160 and 1220 ke.v. are the same level in ^{14}N, the exact position of the peak depending on the particle emitted, and that the neutron resonance at 1825 ke.v. may be the same level in ^{14}N as the 1740 level for γ-ray emission.
N. M. B.

Mechanism of the neutron loss reaction produced by deuterons. M. GOLDHABER (Nature, 1940, **146**, 167).—The possibility that the effect reported by Krishnan and Banks (A., 1940, I, 278) may be due to the reaction ^{63}Cu (*d*, ^{3}H) ^{62}Cu is examined. L. S. T.

Long-period activity induced in copper. S. W. BARNES and G. VALLEY (Physical Rev., 1938, [ii], **53**, 946).—The Cu parts of a cyclotron chamber in which only protons have been accelerated show a radioactivity of ~7 months. Positrons and electrons are emitted in the ratio 2 : 1, and strong γ-radiation is present. L. S. T.

Radioactivity produced by bombarding thallium. K. FAJANS and A. F. VOIGT (Physical Rev., 1940, [ii], **58**, 177; cf. Pool, A., 1937, I, 239).—Highly purified Tl bombarded with slow and fast neutrons and deuterons gave an activity of average half-life $4{\cdot}23\pm0{\cdot}03$ min., and the val. for Ac-*C''* (^{207}Tl) separated chemically from the active deposit of Ac was $4{\cdot}77\pm0{\cdot}05$ min., showing that the products are not identical. Evidence is given that the 4·23-min. activity is ^{204}Tl produced from ^{203}Tl by neutron capture and from ^{205}Tl by the (*n*, 2*n*) reaction. No indication of a 97-min. period was found, but 1—2 hr. deuteron or 4 hr. slow neutron bombardment gave a weak activity of 1—2 years half-life, probably due to ^{206}Tl produced from ^{205}Tl by (*D*, *p*) and (*n*, γ) reactions. Bombardment by deuterons also gave a strong activity of 52 ± 1 hr., chemically identified as Pb; the absorption curve in Al indicates an energy of 500 ke.v. Results suggest that the activity is due to a metastable state in ^{204}Pb or ^{206}Pb which emits a γ-ray which is internally converted into the observed β-rays. N. M. B.

Induced radioactivity of rhenium and tungsten. K. FAJANS and W. H. SULLIVAN (Physical Rev., 1940, [ii], **58**, 276).—Fast neutron bombardment of Re and deuteron bombardment of W gave a new activity of 52 ± 2 days half-life, identified as ^{184}Re. The reactions are probably ^{185}Re (*n*, 2*n*) ^{184}Re and ^{183}W (*d*, *n*) ^{184}Re or ^{184}W (*d*, 2*n*) ^{184}Re. It is a negatron emitter having a γ-ray of $0{\cdot}85\pm0{\cdot}1$ Me.v. associated with it. The following identifications of known isotopes are confirmed: ^{188}Re (18 hr.), ^{186}Re (90 hr.), ^{187}W (24 hr.), and ^{185}W (74·5 days) (cf. Minakawa, A., 1940, I, 340). The upper limit of the β-ray energy of ^{187}W is $1{\cdot}40\pm0{\cdot}05$ and that of ^{185}W is 0·55—0·72 Me.v.; a γ-ray of $0{\cdot}87\pm0{\cdot}03$ Me.v. is associated with ^{187}W. Both activities are negatron emitters. N. M. B.

Artificial radioactivity of chromium. T. AMAKI, T. IIMORI, and A. SUGIMOTO (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 395—398).—Bombardment of Cr with slow and fast neutrons and with fast deuterons produces radioactive isotopes ^{51}Cr (~14 days) and ^{55}Cr (1·7 hr.). The latter is not found with fast neutron bombardment. A 3—4 hr. activity found with fast neutrons is ascribed to ^{50}V.
L. J. J.

Structure of the lower excited levels of the ^{80}Br nucleus. A. P. GRINBERG and L. I. ROUSSINOV (Physical Rev., 1940, [ii], **58**, 181).—Absorption measurements in Al with selective filters give ~37 ke.v. for the energy of the γ-rays from ^{80}Br obtained by a cyclotron. The decay period of the γ-radiation is 4·5 hr. On a scheme fitting experimental results the total excitation energy of the metastable Br nucleus is 85 ke.v., and from this level there are transitions by internal conversion to a lower excited level at 37 ke.v., from which there is a γ-transition only partly associated with internal conversion (cf. Valley, A., 1940, I, 4). The estimated val. of the internal conversion coeff. for the lower transition is 0·5 (assuming 1 for the upper transition), a val. which may be associated only with a dipole electric transition.
N. M. B.

Seven-day uranium activity. E. McMILLAN (Physical Rev., 1940, [ii], 58, 178).—Radioactive ^{237}U reported by Nishina (cf. A., 1940, I, 340) has been found in samples of U placed behind a Be target bombarded by 16-Me.v. deuterons, and showed $7{\cdot}0\pm0{\cdot}2$ days half-life. Immediate purification showed the 23-min. U and its 2·3-day product (cf. McMillan, *ibid.*) but with purification after a delay only the 7-day period was seen. The initial intensity ratio of the 7-day to the 2·3-day activity was ~1 : 8. The same result was found from the decay curve of a thin U layer placed behind the target. Evidence is given that the daughter product must be element 93. After allowing an 80-μ-curie sample of 7-day U to decay for 26 days, element 93 was extracted from it by the method of fluoride pptn. in reducing and oxidising media, with Ce carrier. The resulting product showed no measurable β- or α-ray activity, so its period must be very long. N. M. B.

Regularities among the heavy nuclei. L. A. TURNER (Physical Rev., 1940, [ii], **58**, 181—182).—An amplification of previous discussions (cf. A., 1940, I, 307) in the light of new experimental data.
N. M. B.

Mass of cosmic-ray particles. R. M. LANGER (Physical Rev., 1938, [ii], **54**, 237).—A discussion.
L. S. T.

Cosmic rays and Poisson's law. A. GIBERT (Nature, 1940, **146**, 198).—The validity of applying Poisson's law to cosmic-ray nos. has been investigated. L. S. T.

Latitude effects in cosmic rays at far southern latitudes. E. T. CLARKE and S. A. KORFF (Physical Rev., 1940, [ii], **58**, 179—180).—Intensities as measured by an electroscope and by a counter on an Antarctic route are plotted and discussed. Results show that the average sp. ionisation per ray at sea level remains const. with change of latitude above the curve inflexion at ~38° S. geomagnetic latitude, indicating that the ratio of electrons to mesotrons is const. N. M. B.

Pair production of mesotrons at 29,000 feet. G. HERZOG and W. H. BOSTICK (Physical Rev., 1940, [ii], **58**, 278; cf. A., 1940, I, 188).—Curvature and ionisation considerations of cloud-chamber tracks in a magnetic field of 700 gauss up to 29,000 ft. indicate that the pair consists of a slow positive and a slow negative mesotron. N. M. B.

Radiative processes involving fast mesons. F. BOOTH and A. H. WILSON (Proc. Roy. Soc., 1940, **A**, **175**, 483—518).—The general theory of the interaction of mesons with an electromagnetic field is developed and applied to the scattering of light by mesons, the emission of radiation by mesons during collisions, and the production of pairs of mesons. The experimental data concerning the energy losses of "heavy electrons" in cosmic rays are discussed and are shown to be consistent with the view that the heavy electrons have spin 1. G. D. P.

Mesotron–electron collisions. S. TOMONAGA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 399—413).—For the case of collisions involving mesotrons, Williams' "collision-parameter" method is extended to take the effect of spin into account. The method is applied to at. ionisation and the production of electron–positron pairs by mesotrons. L. J. J.

Barytron theory of nuclear forces. H. A. BETHE (Physical Rev., 1938, [ii], **53**, 938).—A discussion. L. S. T.

Nuclear excitation functions for high-energy charged particles. M. S. PLESSET and D. H. EWING (Physical Rev., 1938, [ii], **53**, 943).—A Coulomb model is proposed. L. S. T.

Radiative losses by particles of anomalous magnetic moment. S. B. BATDORF and E. W. BETH (Physical Rev., 1938, [ii], **54**, 237).—Theoretical. L. S. T.

Dirac equation with spin greater than 1/2. A. BRAMLEY (Physical Rev., 1938, [ii], **54**, 314—315).—Theoretical. L. S. T.

Virtual levels of ^{8}Be and the α-particle model. (MISS) J. E. ROSENTHAL (Physical Rev., 1938, [ii], **54**, 315).—Theoretical. A mol. model does not account for the existence of virtual levels. L. S. T.

Magnetic moments of odd nuclei. H. MARGENAU and E. WIGNER (Physical Rev., 1940, [ii], **58**, 103—110; cf. Inglis, A., 1940, I, 92).—Mathematical. Consideration of a generalisation of Schmidt's single-particle model (cf. A., 1937, I, 440) indicates that the orbital part of the magnetic moment is essentially that following from the liquid drop model and the spin part is identical with that of Schmidt. The model fails to explain the near equality found experimentally for the moments of isotopes. N. M. B.

Directional correlation of successive quanta. D. R. HAMILTON (Physical Rev., 1940, [ii], **58**, 122—131).—Mathematical. The correlation between the directions of propagation of the quanta emitted in two successive transitions of a single radiating system (cf. Dunworth, A., 1940, I, 278) is described by a function $W(\theta)$ giving the relative probability that the second quantum will be emitted at an angle θ with the first; W is determined by the angular moments of the three levels involved in the two transitions and by the multipole order of the radiation emitted in these transitions. The explicit forms of W for all angular momenta and for dipole and quadrupole radiation are given. N. M. B.

Theoretical constitution of metallic beryllium. C. HERRING and A. G. HILL (Physical Rev., 1940 [ii], **58**, 132—162).—Mathematical. By a self-consistent field method, calculations (for the first time for metals other than univalent) are made of total energy as a function of lattice const. and of other properties of Be. The validity for higher valencies and the practicability of the calculational methods are examined. Results for binding energy, lattice const., and compressibility show fair agreement with experiment, but discrepancy of the calc. work function suggests a large deviation of the exchange energy from the val. for completely free electrons. Electronic energies and wave functions in the crystal were calc. by the "orthogonalised plane wave" method (cf. A., 1940, I, 342). N. M. B.

Spinor equations for particles with arbitrary spin and rest mass zero. J. S. DE WET (Physical Rev., 1940, [ii], **58**, 236—242).—Mathematical. A simplified derivation of the results of Fierz (Helv. Phys. Acta, 1940, **13**, 45). N. M. B.

Partially inverted multiplets in Mg I. L. PINCHERLE (Physical Rev., 1940, [ii], **58**, 251—254; cf. Meissner, A., 1938, I, 219).—Mathematical. Using Fermi–Thomas statistical eigenfunctions, the separations of the $3s3d^3D$ term of Mg I are evaluated, taking into account all the magnetic interactions in the atom and the electrostatic interactions with other configurations. The smallness of the observed separations is due to the large val. of the exchange integrals of the magnetic actions. N. M. B.

Transport cross-section of helium. E. J. HELLUND (Physical Rev., 1940, [ii], **58**, 278—279).—Mathematical. An attempt to determine the form of the cross-section necessary to fit experimental low-temp. η data. N. M. B.

Mercury–thallium molecular bands. J. G. WINANS and F. J. DAVIS (Physical Rev., 1938, [ii], **53**, 930).—Four bands or band systems emitted by heated Hg + Tl in a quartz tube, and attributable

to Hg–Tl mols., are recorded. With high pressure of Hg and high [Tl] the bands are very strong.
L. S. T.

New absorption bands of water vapour in the extreme ultra-violet. J. J. HOPFIELD (Physical Rev., 1938, [ii], **53**, 931).—Bands in the regions 996—1239 A. and 1260—1377 A. are recorded. Another system can be traced between 900 and 970 A., and fades to continuous absorption on the short-λ side of 900 A. The bands have a diffuse appearance characteristic of triat. mols. L. S. T.

Rotational analysis of some CS_2 bands in the near ultra-violet system. L. N. LIEBERMANN (Physical Rev., 1940, [ii], **58**, 183; cf. Mulliken, A., 1936, 13).—Some bands of the λ 3200 absorption system were resolved; they include parallel and perpendicular types. B vals. obtained from the analysis of the $\lambda\lambda$ 3501, 3467, 3637, and 3601 rotational bands are given. The perturbation of the rotational levels of the common upper state of the λ 3501 and λ 3601 bands is discussed. N. M. B.

Comparison of the absorption spectra of gaseous and solid benzene. A. L. SKLAR, H. SPONER, and G. NORDHEIM (Physical Rev., 1938, [ii], **53**, 932).—Similarities in both spectra are pointed out, and new progressions are recorded and discussed.
L. S. T.

Infra-red absorption of mixtures of phenol and ethyl alcohol. J. W. WHITE and E. K. PLYLER (Physical Rev., 1938, [ii], **53**, 932).—An absorption band in the region of 6·7 μ. shows changes in intensity and position for the different concns. The shape or sharpness of the bands in the region 6—12 μ. is largely affected by the concn. of the solution, and the change in the bands indicates marked association between PhOH and EtOH. Near 2·7 μ. the effects are more pronounced, possibly owing to interaction of the OH groups of the two substances. L. S. T.

Relative emission spectra of zinc silicates and other cathodo-luminescent materials. H. W. LEVERENZ (Physical Rev., 1938, [ii], **53**, 919—920).—Spectroscopically-pure α-$ZnSiO_4$ has a broad, weak luminescence peaked at 4200 A. As Mn activator is added this band gradually disappears, and a narrow, strong band, peaked at 5250 A., is produced. Spectral efficiency curves for Mn-activated β-Zn silicates, α-Zn germanates, α-Zn Be silicates, etc. have been obtained. Group IVA silicates resurrect the emission spectrum of the pure $ZnSiO_4$, and permit the synthesis of phosphors having practically white emission colours.
L. S. T.

Luminescent materials. II. Fluorescence spectra of zinc sulphide–copper crystal phosphors at −185°, 20°, and 150°. Y. UEHARA (Bull. Chem. Soc. Japan, 1940, **15**, 214—223; cf. A., 1940, I, 147).—Pure ZnS phosphors exhibit 4 fluorescence bands at 4670, 4870, 5085, and 5455 A., whilst those activated by Cu give 3 bands at 4245, 4410, and 5260 A. Corresponding electronic transitions are suggested. The result of varying the amount of activator or the temp. is in accord with theoretical expectation. The energy distribution curves are markedly affected by the presence of KCl used as a flux. F. L. U.

Ionisation and dissociation of normal and *iso*-butane by electron impact. R. F. BAKER and J. T. TATE (Physical Rev., 1938, [ii], **53**, 944).—The processes and products of ionisation and dissociation by electron impact in *n*- and *iso*-C_4H_{10} have been investigated with a mass spectrometer. The ionisation potential of $9 \cdot 8 \pm 0 \cdot 2$ v. is the same for both isomerides. The most abundant ion in both mols. is Pr^+, indicating that fission of a Me with ionisation of the remaining radical is more probable than ionisation of the complete mol. Et^+ is more abundant in *n*- than in *iso*-C_4H_{10}. The appearance potentials show that the C–H linking energy in C_4H_{10} is > the C–C linking energy. L. S. T.

Photo-conductance of silver bromide containing silver iodide. N. KAMEYAMA and K. MIZUTA (J. Soc. Chem. Ind. Japan, 1939, **42**, 426B).—AgI in AgBr in mol. ratios 1·6—2·5% increases the spectral conductance in the spectral range in which pure AgBr is sensitive, and widens the sensitive range towards longer λ. W. A. R.

Paramagnetic rotation of the plane of polarisation. J. BECQUEREL and W. J. DE HAAS (Comm. Kamerlingh Onnes Lab., 1936, Suppl. 81a, 11 pp.; Chem. Zentr., 1937, i, 3601; cf. A., 1936, 148).—An accurate study of tysonite at very low temp. shows that paramagnetic rotation resembles paramagnetism in possessing temp.-dependent and -independent components; the former requires a mol. field, as in Weiss paramagnetism. The rotation of siderite is anomalous. At liquid He temp. the Faraday effect is very small, negative, and independent of temp.; at liquid H temp. it increases rapidly, and from liquid N temp. upwards it falls with rising temp. Van Vleck and Hebb's theory of the paramagnetic rotation of rare-earth salts is verified, except for Sm and Eu. A. J. E. W.

Electric breakdown of alkali halides. R. J. SEEGER and E. TELLER (Physical Rev., 1940, [ii], **58**, 279—280; cf. A., 1938, I, 601; 1939, I, 551).—Mathematical. An improved equation for the breakdown field is derived and vals. calc. therefrom are compared with experimental data. Deviations suggest the omission of various physical factors.
N. M. B.

Resonance in the chloroacetic acids. R. P. BELL (Nature, 1940, **146**, 166—167).—Evidence lending some support to the view that a resonance structure plays a part in the $CHCl_2 \cdot CO_2'$ ion (A., 1940, I, 285) is quoted, but the effects observed are < expected if resonance is a major cause of a 30-fold increase in K on passing from $CH_2Cl \cdot CO_2H$ to $CHCl_2 \cdot CO_2H$.
L. S. T.

Viscosity and molecular structure. H. MARK and R. SIMHA (Nature, 1940, **146**, 167—168).—A correction (cf. A., 1940, I, 289). L. S. T.

Free fall of molecules. I. ESTERMANN, O. C. SIMPSON, and O. STERN (Physical Rev., 1938, [ii], **53**, 947—948).—Observation of the deflexion of mols. by gravity shows that the intensity distribution is in agreement with Maxwell's law of velocity distribution.
L. S. T.

Rotational magnetic moments of H_2, D_2, and HD molecules. Rotational radio-frequency spectra of H_2, D_2, and HD in magnetic fields. N. F. Ramsey, jun. (Physical Rev., 1940, [ii], **58**, 226—236; cf. A., 1940, I, 275).—The spectra for transitions corresponding with re-orientations of the rotational angular momenta of the mols. were obtained, and from these spectra the rotational magnetic moments (all positive) of H_2, HD, and D_2 in the first rotational states are $0{\cdot}8787\pm0{\cdot}0070$, $0{\cdot}6601\pm0{\cdot}0050$, and $0{\cdot}4406\pm0{\cdot}0030$ nuclear magneton, respectively. The relative vals. are in the ratio 4 : 3 : 2 as expected theoretically. The rotational magnetic moment of H_2 in the second rotational state was twice that in the first. The deduced high-frequency contribution to the diamagnetic susceptibility of H_2 is $(0{\cdot}093\pm0{\cdot}007)\times10^{-6}$ per mol. Mol. interaction consts. agree with those from the nuclear re-orientation spectrum. The dependence on orientation of the diamagnetic susceptibility of H_2 in the first rotational state is such that $\xi_{\pm1}-\xi_0=-(4{\cdot}5\pm2{\cdot}0)\times10^{-31}$ per mol.
N. M. B.

Investigation of cold-worked polycrystalline α-iron. L. Mullins and J. W. Rodgers (Proc. Roy. Soc., 1940, **A**, **175**, 422—435).—Microphotometer records of the intensity variation in the *X*-ray reflexions from individual grains are analysed into components arising from the discrete crystal fragments of the deformed grain. The results fall into three groups representing different types of disintegration of the metallic grain. G. D. P.

Orientation of liquid crystals by heat conduction. G. W. Stewart, D. O. Holland, and L. M. Reynolds (Physical Rev., 1940, [ii], **58**, 174—176; cf. A., 1936, 670).—Concordant results are presented of three experimental tests of this new phenomenon in which liquid crystals of *p*-azoxyanisole acquire a preferred orientation under the action of heat conduction in the liquid. A temp. gradient of 1—2° per cm. at ~125° gives a marked effect, and the orientation is indicated by the variation in intensity of the *X*-ray diffraction halo. The effect is probably due to the dominance of acoustic waves of inertia and viscosity in heat conduction in liquids. N. M. B.

Theory of the diffuse scattering of *X*-rays from crystals. G. E. M. Jauncey and G. G. Harvey (Physical Rev., 1940, [ii], **58**, 179; cf. A., 1939, I, 599).—Mathematical. A discussion of Zachariasen (cf. A., 1940, I, 285). N. M. B.

Patterson analysis derived from the cyclol C_2 skeleton. D. Riley (Nature, 1940, **146**, 231).—A reply to criticism (cf. A., 1940, I, 350). The Patterson map obtained by placing the cyclols in the insulin (I) unit cell with a tilt of 6° has been re-calc. numerically, and the essential part of the resulting contour diagram is reproduced and discussed. The new Patterson analysis is not in sufficient agreement with experimental data for (I) to afford evidence in favour of the cyclol hypothesis. L. S. T.

Symmetrical arrangement of equal spheres. S. Melmore (Nature, 1940, **146**, 199). L. S. T.

Finite complexes in crystals : a classification and review. A. F. Wells (Phil. Mag., 1940, [vii], **30**, 103—134).—Where the interat. binding in crystals is not all of one type, aggregates of atoms within which the binding is of one kind may be distinguished from those in which it is of another kind. These groups may be finite (mols. and complex ions) or may extend as infinite chains or layers through the crystal. The finite complexes are classified and discussed. The constitution of the heteropoly-acids which have ions of the type $(P_xW_yO_z)^{n-}$, where P may be replaced by As, Si, B, I, etc., and W by Mo, V, etc., and where $y/x \gg 6$, is discussed. A. J. M.

Scattering of 50-kv. electrons by aluminium. C. T. Chase and R. T. Cox (Physical Rev., 1940, [ii], **58**, 243—251; cf. Rose, A., 1940, I, 185).—Apparatus is described for scattering electrons with thin foils and measuring the intensity of scattering in a narrow pencil at 30—120° with the direction of incidence. The theory of nearly single scattering is discussed, and a general expression for the error due to slight plural scattering is found. For 50-kv. electrons scattered by thin composite foils of Al on collodion an unexplained difference was found between the intensities of scattering at 90° on the two sides of a foil inclined at 45° to the direction of incidence. Relative intensities, corr. for this asymmetry, for angles 30—120° were within 5% of those predicted by Mott. Observed abs. intensity of scattering from Al (subject to ~20% uncertainty) agreed with prediction. N. M. B.

Magnetic susceptibility variations of lead oxide. M. Peterson (Physical Rev., 1938, [ii], **53**, 933).—The red (tetragonal) form of PbO has a const. susceptibility at $-0{\cdot}164\times10^{-6}$, but that of the yellow (orthorhombic) form varies from $\sim-0{\cdot}164\times10^{-6}$ to $-0{\cdot}169\times10^{-6}$. Two forms of orthorhombic crystals appear to exist. L. S. T.

Changes of electrical resistance due to magnetisation of single crystals of iron and nickel. K. Honda, T. Hirone, and N. Hori (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 850—860).—The effect of magnetisation on the electrical resistance of Fe and Ni single crystals is calc. on the basis of Fowler statistics. L. J. J.

Photo-conductance of dye-sensitised silver bromide and the mechanism of dye-sensitisation. N. Kameyama and K. Mizuta (J. Soc. Chem. Ind. Japan, 1939, **42**, 426—427B).—The spectral range of photo-conductance of AgBr crystals containing adsorbed erythrosin, indo-, thiocarbo-, and thiocarbo-indo-cyanine is the same as that of their photographic sensitivities. In the range sensitised by the dye electrons are set free or raised to the conductance band by the energy of the light absorbed by the adsorbed dye. W. A. R.

Nature of the Hall effect. E. Weber (Physical Rev., 1938, [ii], **53**, 934—935).—It has been shown experimentally that under the simultaneous action of the electric field in the direction of the main current and the magnetic field perpendicular to the current the electron flow is non-uniform, so that the Hall effect is caused by a primary deflexion of the current.
L. S. T.

Interferences from the characteristic radiation of crystals in rotation and powder diagrams. C. FINBACK and O. HASSEL (Avh. norsk. Vidensk.-Akad. Oslo. I. Mat.-nat. Kl., 1937, No. 2, 7 pp.; Chem. Zentr., 1937, i, 3602; cf. A., 1937, I, 152).—Interferences due to radiation from atoms in the lattice are attributed to Einstein's " induced " radiation. A. J. E. W.

Permeability of iron and nickel for Hertzian waves. K. F. LINDMAN (Z. tech. Physik, 1940, **21**, 27—30).—Theoretical. Previous results (A., 1939, I, 555) are not in quant. agreement with the theories of Sommerfeld and Laville (Ann. Physik, 1924, **2**, 328). Vals., of the permeability of Fe and Ni calc. from these theories do not agree but in both cases the permeability decreases rapidly for λλ <50 cm. O. D. S.

Paramagnetism. W. J. DE HAAS and J. VAN DEN HANDEL (Comm. Kamerlingh Onnes Lab., 1936, Suppl. 81b, 12 pp.; Chem. Zentr., 1937, i, 3925).—A general report, chiefly on work at low temp. The following topics are discussed with reference to χ data: crystal fields in Dy, Ce, Pr, Nd, and Er Et sulphates; anomalies due to Sm (in Sm_2O_3); paramagnetism in the Fe group (Cr salts and V alum); the magneto-caloric effect in V alum. Cr alum obeys the Curie law with $\Theta = 0$ at $\nless 1{\cdot}3°$ K. Relaxation times for paramagnetic ions in high-frequency fields are determined (cf. Gorter, A., 1936, 929). A. J. E. W.

Magnetic studies of co-ordination compounds. I. Cobaltous compounds, with special reference to their resolvability. D. P. MELLOR and R. J. GOLDACRE (J. Proc. Roy. Soc. New South Wales, 1940, **73**, 233—239).—Using the Gouy method, the magnetic susceptibilities of $Co(NH_3)_6Cl_2$, $[Co\ en_3]Cl_2$, $Co(C_9H_8N)_2Cl_2,H_2O$, $Na[Co\{C_6H_4(CO_2)_2\}_2],H_2O$, and $(NH_4)_2Co(CNS)_4,4H_2O$ have been measured and the magnetic moments deduced. All are paramagnetic, indicating that Co^{II} forms electrostatic bonds, whereas in the analogous Co^{III} compounds the bonds are covalent. This difference is reflected in the chemical behaviour and stability of the analogues, the Co^{II} members being the less stable, and by the fact that tetrahedral or octahedral complexes of Co^{II} have not been resolved. W. R. A.

Ultrasonic study of carbon dioxide near its critical point. J. C. HUBBARD and C. M. HERGET (Physical Rev., 1938, [ii], **53**, 945). L. S. T.

Absorption of sound in carbon dioxide and in carbon disulphide. V. O. KNUDSEN and E. FRICKE (Physical Rev., 1938, [ii], **54**, 238).—Measurements in pure CO_2 at 1 atm. and 22° confirm the collision theory of anomalous absorption as developed by Einstein, Kneser, and others. The absorption coeff. is appreciable at νν as low as 2×10^3 cycles, and increases to a max. of 0·317 per λ at 77×10^3 cycles. This indicates that the deformation and symmetrical valency vibrations both take part in the exchanges between vibrational and translational energy. Small amounts of impurity, *e.g.*, H_2O or EtOH, markedly affect absorption, and shift the absorption band to higher νν. Measurements in mixtures of CO_2 in O_2 or in N_2 indicate that neither O_2 nor N_2 is appreciably excited by collisions with CO_2. CS_2 shows an absorption similar to that of CO_2, but beginning at 10^4 cycles. In mixtures of CS_2 and O_2, the absorption observed at $<10^4$ indicates that only the vibration of O_2 mols. is excited by collisions with CS_2 mols. At higher νν CS_2 mols. also are excited, mainly by collisions with other CS_2 mols. L. S. T.

Optical dispersion and molar refraction at zero frequency for compressed nitrogen, argon, and carbon dioxide measured as functions of density. C. E. BENNETT (Physical Rev., 1940, [ii], **58**, 263—266; cf. A., 1934, 348).—Data obtained by displacement interferometry are reduced to give the variation of n (at $\lambda = \infty$) with density for pure N_2 for $d = 0{\cdot}0043$—$0{\cdot}0165$ g. per c.c. Data for dispersion in A for 0—18 atm. are tabulated, and the Cauchy consts. calc. for n.t.p. are $A_0 - 1 = 0{\cdot}0002771 \pm 0{\cdot}0000008$, $B_0 = 1{\cdot}477 \times 10^{-14}$. The Lorentz–Lorenz function, and hence $[R]$ at $\nu = 0$, are independent of density for N_2 and A. $[R]$ for N_2 is $4{\cdot}369 \pm 0{\cdot}003$, and for A $4{\cdot}138 \pm 0{\cdot}012$ c.c. For CO_2 there is evidence of a slight negative deviation from linearity for $(A-1)$ with density, and a marked negative variation of the Lorentz–Lorenz function with density, indicating a decrease in $[R]$ at $\nu = 0$ and suggesting a decrease in the mol. polarisation with density, contrary to the findings of Keyes (cf. Chem. Rev., 1936, **19**, 195). The n.t.p. vals. of the Cauchy consts. for CO_2 are: $(A_0 - 1) = 0{\cdot}0004419 \pm 0{\cdot}0000036$, and $B_0 = 2{\cdot}791 \times 10^{-14}$. The extrapolated $[R]$ at $\nu = 0$ is $\sim 6{\cdot}65$ c.c. N. M. B.

B.p. of *n*-alkyl primary amines. A. W. RALSTON, W. M. SELBY, W. O. POOL, and R. H. POTTS (Ind. Eng. Chem., 1940, **32**, 1093—1094).—B.p. at various pressures from 1 to 760 mm. are recorded for primary *n*-alkylamines from C_6 to C_{18}; b.p. apparatus is described. Other physical consts. are recorded for amines and corresponding nitriles. Reciprocals of the b.p. plotted against logarithms of pressures give slightly curved lines, indicating slight association of primary amines in the liquid state. A. T. P.

B.p.–mol. wt. chart for higher hydrocarbons. D. S. DAVIS (Ind. Eng. Chem., 1940, **32**, 1148).—A chart relating the mol. wt., no. of C atoms per mol., and b.p./1 mm. for higher hydrocarbons is given. J. W. S.

Adiabatic demagnetisation of paramagnetic salts. W. J. DE HAAS and E. C. WIERSMA (Comm. Kamerlingh Onnes Lab., 1936, Suppl. 81c, 12 pp.; Chem. Zentr., 1937, i, 3607).—By the use of a new inductive method the following temp. have been reached by adiabatic demagnetisation of the substances named from a starting temp. of $\sim 1{\cdot}2°$ K.: Fe and Cr alums, 0·017° and 0·016°; $CeEt(SO_4)_2$, 0·082°; Ti alum and Cr alum diluted 14·4-fold with Al alum, $<0{\cdot}005°$ K. V alum gives no effect, as its sp. heat at 1·2° K. is too high. A. J. E. W.

Heat effects of tridymite inversions. A. Q. TOOL (Physical Rev., 1938, [ii], **53**, 945—946).—The heat effects in the heating and cooling curves for tridymite obtained by heating SiO_2 gel containing

~1% of $Na_2B_4O_7$ at 950° for six months are described; they may be due to heterogeneity of the crystals. L. S. T.

Vapour pressure curves of thallium. J. FISCHER (Festschr. Tech. Hochschule Breslau, 1910—1935, 172—198; Chem. Zentr., 1937, i, 4208).—The v.p. (p mm.) have been determined by the Knudsen effusion method at ~800—926·7° K., and by the condensation method (in H_2 or A) at 1247—1400° K. At 900—1700° K., $\log p = -(45{,}320/4{\cdot}571T) - 1{\cdot}75 \log T + 14{\cdot}27$; the effusion method alone gives $\log p = -(44{,}800/4{\cdot}571T) - 1{\cdot}75 \log T + 14{\cdot}13$. The Trouton const. is 22·6. A. J. E. W.

Determination of the vapour pressure of solid salts. III. Vapour pressure of TlCl, TlBr, TlI, $PbCl_2$, $PbBr_2$, PbI_2, $ZnCl_2$, $ZnBr_2$, ZnI_2, $CdCl_2$, $CdBr_2$, and CdI_2, and calculation of their thermodynamic values. K. NIWA (J. Fac. Sci. Hokkaido, 1940, [iii], 3, 17—33; cf. A., 1939, I, 311). —V.p. of TlCl (270—360°), TlBr (270—340°), TlI (270—340°), $PbCl_2$ (380—460°), $PbBr_2$ (330—360°), PbI_2 (306—377°), $ZnCl_2$ (270—330°), $ZnBr_2$ (240—310°), ZnI_2 (220—280°), $CdCl_2$ (370—480°), $CdBr_2$ (320—410°), and CdI_2 (260—330°) have been determined by Knudsen's method. Heat of sublimation, mol. energy, chemical const., free energy change, entropy change of sublimation, and entropy of salt-vapour are calc. A. Li.

Effects of pressure and temperature on the viscosity of monosubstituted toluenes. H. E. MORGAN and R. B. DOW (Physical Rev., 1938, [ii], **54**, 312).—The η of *o*-, *m*-, and *p*-chloro-, -bromo-, -nitro-, and -iodo-toluene has been determined at 30°, 75°, and 99°, at pressures from atm. to 4000 kg. per sq. cm., by means of the rolling-ball type of high-pressure viscosimeter. The applicability and validity of the log coeff. of η–pressure relation to represent the data are discussed. No general rule for the effect of change of position of the substituted group can be stated. A fundamental difference in the vibration of the PhMe ring when the substituent is in the *p*-position is indicated. L. S. T.

Theory of the thermal diffusion coefficient for isotopes. R. C. JONES (Physical Rev., 1940, [ii], **58**, 111—122; cf. A., 1940, I, 230).—Mathematical. The first approximation to the thermal diffusion const. α of a mixture of two isotopes is derived from Enskog's theory of thermal diffusion. The general formula for α is worked out explicitly for the elastic sphere, inverse power, Sutherland, and Lennard-Jones models and results are compared with available experimental data. The validity of mol. models of kinetic theory is examined critically. N. M. B.

Strains produced by precipitation in alloys. F. R. N. NABARRO (Proc. Roy. Soc., 1940, **A**, **175**, 519—538).—The strain set up in an alloy when a new phase is in process of pptn. is investigated theoretically. The energy involved is calc. for a variety of different shapes of pptd. particle, and is least for thin plates. The calc. shape agrees with that observed experimentally. G. D. P.

Vapour pressures and b.p. of binary mixtures of hydrogen peroxide and water. P. A. GIGUÈRE and O. MAASS (Canad. J. Res., 1940, **18**, **B**, 181—193).—The v.p. of H_2O_2–H_2O mixtures and the compositions of their saturated vapours have been measured at 30°, 45°, and 60°, and over the entire concn. range. The heats of vaporisation and the normal b.p. of the solutions are deduced. The total v.p.–composition curves show large negative deviations from Raoult's law, but have no min. The partial pressures of the components and their activities in the solutions are calc. These can be explained from the polar nature of the liquids. J. W. S.

Accumulation of sulphur dioxide in sodium phosphate solutions. G. P. LUTSCHINSKI and R. M. TAVROVSKAJA (J. Appl. Chem. Russ., 1940, **13**, 421—427).—The solubility of SO_2 in aq. Na_2HPO_4 is $\propto$ concn. The partial SO_2 and H_2O pressures above the solutions are $\propto$ [SO_2] and [H_2O]. Dissolved SO_2 is quantitatively eliminated by boiling the solutions. R. T.

Absorption of gases by a drop of liquid. K. SCHABALIN (J. Appl. Chem. Russ., 1940, **13**, 412—420).—The velocity of absorption of NH_3 by a falling drop of H_2O is $\propto$ duration of contact, and inversely $\propto$ diameter of the drop; it is in general determined by the resistance of the absorption film. The same considerations apply to absorption of CO_2, except that in this case convection currents within the drop are of importance. Such currents are practically absent from very small droplets, for which reason a certain optimum drop diameter should exist for each gas, depending on its solubility. R. T.

Interferometer method for measuring absolute adsorption in surface of solutions. J. W. MCBAIN, G. F. MILLS, and T. F. FORD (Trans. Faraday Soc., 1940, **36**, 930—935).—The method previously reported (A., 1936, 423) is described in detail and used to measure the adsorption of $Ph{\cdot}[CH_2]_2{\cdot}CO_2H$ and $C_{12}H_{25}{\cdot}SO_3H$ at the air–solution interface. The results agree fairly with the predictions of the Gibbs theorem. F. L. U.

Changes in viscosity of agar sol with concentration. S. N. BANERJI and S. GHOSH (Proc. Nat. Acad. Sci. India, 1939, **9**, 144—147).—1% agar sol kept for 6—8 min. in contact with a small piece of ready-formed gel of the same concn. shows a large increase in η compared with a similar untreated sol. The effect is greater at 40° than at 50°. The η–concn. relation of agar sols cannot be represented by the formulæ of Arrhenius, Hess, or Hatschek. The rapid increase of η with concn. is attributed to increase in rigidity and in the relaxation time rather than to high solvation. F. L. U.

Changes in viscosity of agar sol with temperature. S. N. BANERJI and S. GHOSH (Proc. Nat. Acad. Sci. India, 1939, **9**, 148—153).—The η of agar sol has been measured for different concn. and temp. The results are in accord with Madge's formula. The high temp. coeff. is interpreted on the assumption of rigidity caused by quasi-cryst. orientation of the micelles. F. L. U.

***Hevea* latex. Effect of proteins and electrolytes on colloidal behaviour.**—See A., 1940, III, 764.

Periodic precipitation in absence of foreign gel. III. Ferric phosphate and ferric arsenate sols. IV. Ferric borate sol. R. N. MITTRA (Proc. Nat. Acad. Sci. India, 1939, 9, 131—137, 138—143).—III. Sols of $FePO_4$ and $FeAsO_4$ produce rings when coagulated with suitable amounts of K_2SO_4. Data for the speed of coagulation are recorded.

IV. Fe^{III} borate sol also shows ring formation with K_2SO_4. Details are given. The effect in all three sols is governed, as in the $Fe(OH)_3$ sols previously studied (cf. A., 1939, I, 417), by the speed of coagulation, the vol. of ppt., and adsorption of sol by the coagulum. F. L. U.

Thermal transpiration of a dissociating gas. B. N. SRIVASTAVA (Proc. Roy. Soc., 1940, **A**, **175**, 474—483).—The thermal transpiration of a dissociating gas is investigated theoretically for two chambers at different temp. joined by a narrow opening. The condition of thermodynamic equilibrium and the usual transpiration relation for each constituent cannot be satisfied. Rigorous and approx. solutions of the problem are obtained. G. D. P.

Concentration of cations at negatively-charged surfaces. D. A. WEBB and J. F. DANIELLI (Nature, 1940, **146**, 197—198).—The p_H at the surface of cetyl sulphate micelles calc. from the Gibbs–Donnan equilibrium agrees with vals. obtained by other methods (cf. A., 1940, I, 110). Chemical analysis of palmitate monolayers spread on solutions containing different concns. of $Na^{\cdot}$ and $Ca^{\cdot\cdot}$ shows that, as predicted by this equilibrium, the $Na^{\cdot} : Ca^{\cdot\cdot}$ ratio in the surface is $<$ that in the bulk, but is $\ll$ the predicted val. This indicates that $Ca^{\cdot\cdot}$ is bound at the interface by forces additional to electrostatic attraction. The negatively-charged surfaces act as reservoirs of bivalent ions, and their discharge or dissolution releases a disproportionate amount of bivalent ions. L. S. T.

Minimum and equilibrium concentrations. I. A. M. BELOUSOV and A. P. TERENTIEVA (J. Appl. Chem. Russ., 1940, **13**, 463—469).—The min. $[Ba^{\cdot\cdot}]$ at which turbidity is observed in presence of SO_4'' is expressed by $C_{min.} = \beta L_p/[SO_4'']$, where L_p is the solubility product of $BaSO_4$, and β is a const., $\sim 10^4$. R. T.

Complex formation in the system $PbCl_2$–$NaCl$–H_2O. B. V. GROMOV (J. Appl. Chem. Russ., 1940, **13**, 337—344).—Formation of double compounds was not observed. R. T.

Heat of dissociation and specific heats of ammonium phosphates and atomic heat of nitrogen. S. SATOH and T. SOGABE (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 861—867).—For $NH_4H_2PO_4$, $(NH_4)_3H_3P_2O_8$, and $(NH_4)_2HPO_4$ between 0° and 99·6°, $c = 0{\cdot}3089$, 0·3309, and 0·3408, respectively. From the mol. heats of the first and last-named, the at. heat of $N = 2{\cdot}27$. These vals. give for the heat of dissociation of $(NH_4)_2HPO_4 \rightarrow NH_4H_2PO_4 + NH_3 - 18{\cdot}5_5$ kg.-cal., using the dissociation pressure measured at high temp. L. J. J.

Equilibria in the system $PbSO_4$–$NaCl$–H_2O. B. V. GROMOV (J. Appl. Chem. Russ., 1940, **13**, 345—356).—In the reciprocal system $PbSO_4 + 2NaCl \rightleftharpoons PbCl_2 + Na_2SO_4$, in H_2O at 25—100°, the stable salts are $PbSO_4$ and $NaCl$, no other solid phases being formed. R. T.

Effect of the "basic" electrolyte on the polarographic wave of cadmium and lead. S. P. SCHAIKIND (J. Appl. Chem. Russ., 1940, **13**, 455—462).—The height h of the wave is $\propto$ concn. over the range 2·5—125 mg. of $Cd^{\cdot\cdot}$ per l. in aq. KCl, Na_2SO_4, $ZnCl_2$, or $ZnSO_4$, or 20—300 mg. of $Pb^{\cdot\cdot}$ per l. in KCl or $ZnCl_2$. Varying the [KCl] from 0·1 to 2M. does not affect the results, whilst in aq. $ZnCl_2$ or $ZnSO_4$ h is $\propto 1/[Zn^{\cdot\cdot}]$. For Cd, h falls in the series KCl, $ZnCl_2$, $ZnSO_4$, and for Pb in the order $Zn^{\cdot\cdot}$, $K^{\cdot}$. In the polarographic determination of Cd and Pb in Zn, the concn. of the accompanying electrolytes in the standard solution should equal that in the test solution. R. T.

Ignition and ignitibility. H. C. PORTER (Ind. Eng. Chem., 1940, **32**, 1034—1036).—The relative ease of ignition of various substances has been compared by determining the current required to be passed through a heater element to cause ignition of the material, enclosed in a bomb under a moderate pressure of O_2, with the heater applied at one point of the material only. The % combustion occurring within 2 min. after ignition is also recorded. Compounds with open-chain structure, or materials containing ingredients with such structure (humic substances or lignin), are more easily ignited than substances containing ring structures. J. W. S.

Explosive properties of *cyclo*propane.—See B., 1940, 653.

Kinetics of the inhibition of the reaction between chlorine and nitric oxide. E. M. STODDART (J.C.S., 1940, 823—831).—The velocity of reaction between Cl_2 and NO does not follow a termol. reaction law, but is affected by surface conditions. The NOCl formed appears to be adsorbed slowly on the surface, thereby inhibiting the surface reaction until it stops completely. It is supposed that the complex mol. $(NO)_2$ is formed in heterogeneous equilibrium with NO, dissociation being almost complete, and that when the $(NO)_2$ mol. is formed on the active surface it is capable of reaction with Cl_2, whereas when formed on an inactive surface it is incapable of reaction. Therefore the total no. of complex mols. is independent of the surface area of the reaction vessel, and the observation of previous workers that the reaction follows a termol. law is attributed to their using surfaces which prevented inhibition. The inhibition and final stoppage of the reaction observed with glass reaction vessels are attributed to slow adsorption of NOCl on the active surface. J. W. S.

Mechanism of elimination reactions. V. Kinetics of olefine elimination from ethyl, *iso*propyl, *tert*.-butyl, and α- and β-phenylethyl bromides in acidic and in alkaline alcoholic solution. Effects due to, and factors influencing, the two mechanisms of elimination. E. D. HUGHES, C. K. INGOLD, S. MASTERMAN, and B. J. MCNULTY (J.C.S., 1940, 899—912; cf. A., 1937, I, 467).—Taylor's method of determining the proportions of olefine formed from alkyl halides (A., 1938, II, 37) leads to considerable errors when volatile

olefines are handled. Some of the reactions studied by Taylor do not proceed at appreciable rates at the temp. used. Studies of the reaction kinetics of the elimination of HBr (with NaOEt) from EtBr, $Pr^{\beta}Br$, $Bu^{\gamma}Br$, CHPhMeBr, and $Ph\cdot[CH_2]_2\cdot Br$ confirm the existence of parallel first- and second-order reactions, and the velocity coeffs. of these constituent reactions are derived. The effects of the structure of the mol., the nature of the solvent, and the concns. in the solution are discussed. J. W. S.

Mechanism of substitution at a saturated carbon atom. XI. Hydrolysis of *tert*.-butyl bromide in acidic moist acetone. L. C. BATEMAN, K. A. COOPER, and E. D. HUGHES. **XII. Hydrolysis of benzhydryl chloride in acidic moist acetone.** M. G. CHURCH and E. D. HUGHES. **XIII. Mechanisms operative in the hydrolysis of methyl, ethyl, *iso*propyl, and *tert*.-butyl bromides in aqueous solutions.** L. C. BATEMAN, K. A. COOPER, E. D. HUGHES, and C. K. INGOLD. **XIV. Unimolecular substitutions of *tert*.-butyl chloride with water, and with anions, as substituting agents in formic acid solution.** L. C. BATEMAN and E. D. HUGHES. **XV. Unimolecular and bimolecular substitutions of *n*-butyl bromide with water, and with anions, as substituting agents in formic acid solution.** L. C. BATEMAN and E. D. HUGHES. **XVI. Hydrolysis of methyl, ethyl, *iso*propyl, and *tert*.-butyl bromides in acidic solutions under conditions believed to be conducive to uniformity of mechanism.** L. C. BATEMAN and E. D. HUGHES. **XVII. Polar effects in alkyl groups as illustrated by solvolytic substitutions of *p*-alkylbenzhydryl chlorides.** E. D. HUGHES, C. K. INGOLD, and N. A. TAHER. **XVIII. Polar effect of the carboxylate ion group as illustrated by the hydrolysis of the bromomalonate and α-bromomethylmalonate ions.** E. D. HUGHES and N. A. TAHER. **XIX. Kinetic demonstration of the unimolecular solvolysis of alkyl halides. A. Kinetics of, and salt effects in, the hydrolysis of *tert*.-butyl bromide in aqueous acetone.** L. C. BATEMAN, E. D. HUGHES, and C. K. INGOLD. **XX. Kinetic demonstration of the unimolecular solvolysis of alkyl halides. B. Kinetics of, and salt effects in, the hydrolysis of benzhydryl halides in aqueous acetone.** M. G. CHURCH, E. D. HUGHES, and C. K. INGOLD. **XXI. Kinetic demonstration of the unimolecular solvolysis of alkyl halides. C. Kinetics of, and salt effects in, the hydrolysis of *p*-monoalkylbenzhydryl halides in aqueous acetone.** M. G. CHURCH, E. D. HUGHES, C. K. INGOLD, and N. A. TAHER. **XXII. Kinetic demonstration of the unimolecular solvolysis of alkyl halides. D. Kinetics of, and salt effects in, the hydrolysis of *pp'*-dimethylbenzhydryl chloride in aqueous acetone.** L. C. BATEMAN, E. D. HUGHES, and C. K. INGOLD. **XXIII. Kinetic demonstration of the unimolecular solvolysis of alkyl halides. E. General discussion.** L. C. BATEMAN, M. G. CHURCH, E. D. HUGHES, C. K. INGOLD, and N. A. TAHER. **XXIV. Qualitative survey of nucleophilic substitutions of benzhydryl halides in sulphur dioxide solution.** L. C. BATEMAN, E. D. HUGHES, and C. K. INGOLD. **XXV. Unimolecular halogen exchange between an alkyl halide and halide ions in sulphur dioxide solution, and a concluding note.** L. C. BATEMAN, E. D. HUGHES, and C. K. INGOLD (J.C.S., 1940, 913—920, 920—925, 925—935, 935—940, 940—944, 945—948, 949—956, 956—960, 960—966, 966—970, 971—974, 974—978, 979—1011, 1011—1017, 1017—1029; cf. A., 1938, II, 304).—XI. The assumption of Taylor (A., 1938, I, 86) that in moist $COMe_2$ $Bu^{\gamma}Br$ reacts with H_2O reversibly, $Bu^{\gamma}Br + H_2O \rightleftharpoons Bu^{\gamma}OH + HBr$, is incorrect, whilst the method of calculation leading to his finding of agreement between observed equilibrium concns. and those calc. for rate consts. is based on false premises. Taylor's observation of approx. identity of the second-order velocity coeffs. for the hydrolysis in $COMe_2$ containing 1 and 2 vol.-% of H_2O is valueless as evidence of a bimol. reaction, as proportionality is to be expected from the unimol. mechanism, when there is no stoicheiometric intervention by H_2O in the rate-measured process.

XII. The equilibrium supposed by Taylor (*ibid*., 627) to exist in the hydrolysis of $CHPh_2Cl$ is shown to be non-existent and his calculation of the equilibrium composition is incorrect. His interpretation of the variation of reaction velocity with H_2O content is contrary to thermodynamics.

XIII. Taylor's views (A., 1937, I, 417; 1938, I, 404; 1940, I, 77) are criticised. It is emphasised that the variation of the velocity of hydrolysis of the bromides is associated with the difference in the mechanism of substitution, the S_N2 form following the order $Me > Et > Pr^{\beta} > Bu^{\gamma}$, and the S_N1 mechanism following the reverse order. The theory is supported by additional data for the hydrolysis in alkaline aq. EtOH and in aq. $COMe_2$, when the reactions are of the second and of the first order, respectively.

XIV. It is shown that HCO_2Bu^{γ} cannot be isolated in quantity from the products of interaction of HCO_2H and $Bu^{\gamma}Cl$ at room temp., and the results of Taylor (A., 1938, II, 40) are attributed to his using a large excess of $(HCO_2)_2Ca$. Addition of $(CH_2Cl\cdot CO_2)_2Ca$ similarly yields $CH_2Cl\cdot CO_2Bu^{\gamma}$. These substitutions are unimol., the anions intervening only after the slow and rate-controlling ionisation of the $Bu^{\gamma}Cl$.

XV. The rate of interaction of $Bu^{\alpha}Br$ in HCO_2H containing H_2O increases linearly with the $[H_2O]$, indicating that the reaction is predominantly bimol., whereas the corresponding reaction with $Bu^{\gamma}Cl$ is unimol. HCO_2' ions accelerate the reaction considerably, indicating that in this case direct attack on the $Bu^{\alpha}Br$ mol. occurs.

XVI. The reactivities of the alkyl bromides during their hydrolysis in wet HCO_2H follow the order predicted previously for the unimol. (S_N1) reaction, viz., $Me < Et < Pr^{\beta} < Bu^{\gamma}$. The effects of increasing the $[H_2O]$ indicate that the bimol. mechanism increases in importance from Bu^{γ} to Me, but is insufficient to produce a rate min., such as is observed in wet $COMe_2$.

XVII. The rates of hydrolysis and alcoholysis of $CHPh_2Cl$ and its *p*-alkyl derivatives have been determined, and the energies of activation are derived. The rates of reaction of the *p*-derivatives accord with

the order of electron release sequence, viz., Me > Et > Pr^{β} > Bu^{γ} > H, thereby demonstrating the reality of the tautomeric displacements of the electrons of the non-ionisable CH groups. That the CH groups do not ionise is confirmed by isotopic indicator tests.

XVIII. The hydrolysis of $CHBr(CO_2Na)_2$ and $CMeBr(CO_2Na)_2$ in dil. NaOH proceeds by a unimol. (S_N1) mechanism. The results are correlated with analogous data for alkyl bromides and the Br-derivatives of fatty acids.

XIX. The initial velocity of hydrolysis of $Bu^{\gamma}Br$ in 70% and 90% aq. $COMe_2$ at 50° is increased by ~1·4 times when the solution is made ~0·1M. in LiBr, LiCl, or NaN_3.

XX. Addition of HCl, LiCl, NaCl, LiBr, or NaN_3 increases the velocity of hydrolysis of $CHPh_2Cl$ and $CHPh_2Br$ in 80% and 90% aq. $COMe_2$, but the special retarding effect of the anions, associated with the unimol. mechanism, is also increased, with the result that under certain conditions this determines the qual. results.

XXI. The hydrolysis of p-$C_6H_4Bu^{\gamma}$·CHPhCl and p-C_6H_4Me·CHPhCl in aq. $COMe_2$, alone and in the presence of HCl, NaCl, LiBr, or NaN_3, shows considerable deviation from first-order kinetics. The results are interpreted as indicating that although the accelerating electrostatic effect of electrolytes in general with these compounds is > with $CHPh_2Cl$ the retarding mass law effect is much greater and therefore controls the reaction velocity.

XXII. The hydrolysis of $CHCl(C_6H_4Me\text{-}p)_2$ (I) in 50—90% aq. $COMe_2$ shows no relation to first-order kinetics. Addition of LiCl decreases the velocity of reaction, whilst LiBr, NaN_3, and $NMe_4·NO_3$ increase it. The effects are attributed to a very large mass effect, arising from the unimol. mechanism. In the presence of NaN_3 the extent of formation of $CHN_3(C_6H_4Me\text{-}p)_2$ is independent of the [(I)] and [H_2O] but dependent on the [N_3'].

XXIII. Evidence that these reactions are unimol. is summarised, and the kinetics of the various stages of the reactions are discussed in detail.

XXIV. The interactions of $CHPh_2Cl$ and m-C_6H_4Cl·CHPhCl with NEt_4F, NMe_4F, C_5H_5N, NEt_3, and H_2O in liquid SO_2 occur at rates which are initially of the same order, indicating that these reactions are unimol., involving initial ionisation of the chlorides.

XXV. The reaction of m-C_6H_4Cl·CHPhCl with F′ and I′ in liquid SO_2 follows neither first- nor second-order laws. From a study of the variation of the initial reaction velocity with [F′] it is shown that the ionic strength effect is unusually large, an ionic strength of 0·05 trebling the velocity. The mass law effect is also very large, and controls the course of the substitution reaction, owing to the gradual development of Cl′ in solution. The results are in quant. accord with theory. J. W. S.

Kinetics of thermal decomposition of calcium carbonate. G. F. Hüttig and H. Kappel (Angew. Chem., 1940, **53**, 57—59).—Arrangements whereby the spatial distribution of reaction in the thermal decomp. of a mass of powdered $CaCO_3$ has been studied are described. In the surface layers there is a rapid decomp. of the first order. In the interior layers the decomp. is slower and of zero order. Between these zones there are regions where the reaction is of intermediate character, with apparently fractional orders. In the surface layers the decomp. itself is the determining factor, but in the inner layers diffusion and thermal conduction play a controlling part. F. J. G.

Reduction of barium oxide by metals at high temperature. J. P. Blewett (Physical Rev., 1938, [ii], **53**, 935).—The rate of evolution of Ba from mixtures of BaO with Ti, Ni, or Mo has been measured. L. S. T.

Catalytic isotope exchange of gaseous oxygen. IX. Preparation and catalytic activity of catalyst. Mixed catalytic action of impurities. N. Morita (Bull. Chem. Soc. Japan, 1940, **15**, 226—234; cf. A., 1939, I, 87).—The exchange of O isotopes between O_2 and H_2O vapour in contact with CuO is little affected by varying either the physical condition of the CuO or its method of prep. CuO that has been soaked in dil. aq. NaOH and dried so as to contain ≯0·2% of NaOH shows enhanced catalytic activity. Pumice, by itself inactive, becomes active when containing a little NaOH, but its activity is still < that of untreated CuO. F. L. U.

[Catalytic] synthesis of benzine.—See B., 1940, 653, 654.

[Catalytic] preparation of butadiene.—See B., 1940, 657.

Activation of hæmatite.—See B., 1940, 667.

Influence of impurities on velocity of dissolution of zinc in sulphuric acid.—See B., 1940, 673.

Cryolite and electrolytic process of aluminium production.—See B., 1940, 675.

Photographic reversal. S. E. Sheppard (Physical Rev., 1940, [ii], **58**, 93; cf. Nafe, B., 1940, 702).—A brief discussion of the theory of reversal. N. M. B.

Quantum yield in chloroacetic acid. L. B. Thomas (J. Amer. Chem. Soc., 1940, **62**, 1879—1880).—The quantum yield at 25° in $CH_2Cl·CO_2H$ for λ 2537 is 0·342, confirming the val. given by Smith *et al.* (A., 1939, I, 573). F. J. G.

Separation of radioactive substances without the use of a carrier. D. C. Grahame and G. T. Seaborg (Physical Rev., 1938, [ii], **54**, 240—241).—Radioactive Ga chloride, obtained from Ga-free Zn bombarded with 8-Me.v. deuterons, can be extracted by Et_2O from the 6N-HCl solution without addition of inactive Ga chloride as carrier. The partition coeffs. between the liquid phases for the chlorides of ^{68}Ga (1 hr.) and ^{67}Ga (83 hr.) are identical with those observed for Ga chloride in ordinary amounts. Extraction methods provide a simple means of separating completely and in the most conc. form the radioactive isotopes of many elements. L. S. T.

Separation of rare earths by electrolytic hydrolysis of their azides. J. Ant-Wuorinen (Suomen Kem., 1940, **13, B**, 1—3).—The mixture of rare-earth hydroxides is dissolved in aq. HN_3, and the solution fractionally hydrolysed by electrolysis in a diaphragm

cell, moving Pt electrodes and a c.d. of 0·05 amp. per sq. cm. being used. Results are given.
M. H. M. A.

Formation of double fluorides of thallium with fluorides of quinquevalent metalloids and metals of the nitrogen group. J. Ant-Wuorinen (Suomen Kem., 1940, **13**, B, 3—4).—Dissolution of the appropriate oxide in HF and addition of TlF gives $TlMF_6$ (M = V, Nb, Sb). The Bi compound could not be obtained. AsF_5 and TlF give probably $TlAsF_6$. All the compounds are very unstable.
M. H. M. A.

Fundamentals and calculation of a new physiocchemical method for determination of individual constituents of mixtures. L. Ebert (Angew. Chem., 1940, **53**, 128—129; cf. Ibing, A., 1940, II, 318).—Improved derivations and simplified formulæ are given. F. J. G.

Physico-chemical determination of components in mixtures.—See A., 1940, II, 318.

Stable 2 : 6-dichlorobenzenone-indophenol solutions. I. Stone (Ind. Eng. Chem. [Anal.], 1940, **12**, 415).—Solutions of Na 2 : 6-dichlorobenzenone-indophenol in dioxan acidified with AcOH are stable for several months. J. D. R.

Sensitive method for determination of moisture.—See B., 1940, 678.

Photo-mechanical method for the determination of atmospheric ozone. B. O'Brien and H. S. Stewart, jun. (Physical Rev., 1938, [ii], **53**, 949).—A photographic method for continuous determination of atm. O_3 from ultra-violet solar spectra of wedge form recorded serially on a film has been developed.
L. S. T.

Determination of pyrites and total sulphur in bituminous coal.—See B., 1940, 652.

Sensitivity of Nessler's solution. K. Suzuki (J. Soc. Chem. Ind. Japan, 1939, **42**, 375B).—Nessler's solution is the more sensitive, the lower is the [KI]. Small amounts of HCl do not interfere, but in presence of high concns. the solution becomes quite insensitive.
W. A. R.

Group separation for the quantitative and qualitative analysis of phosphates. G. J. Austin (Analyst, 1940, **65**, 335—347).—Groups I and II are removed as usual. Ba and Sr are pptd. as sulphates from a solution ~0·2N. with respect to HCl. Fe, Al, and Cr are pptd. as phosphates at p_H 3·2—3·4. Zn, Ni, and Co are pptd. by buffering the solution to p_H 4·6—4·8 and passing H_2S. The H_2S is boiled off; Mn is oxidised with NaOCl and pptd. as MnO_2. Ca is pptd. as oxalate. The solution is then made ammoniacal and Mg pptd. as phosphate. Na and K are tested for separately. Tables of the quant. adsorption of metals of the Fe-group phosphates indicate that the method compares well with the basic acetate method in this respect. E. C. B. S.

Quantitative analysis by X-ray diffraction. I. Determination of quartz. J. W. Ballard, H. I. Oshry, and H. H. Schrenk (U.S. Bur. Mines, Rept. Invest. 3520, 1940, 10 pp.).—The application of X-ray diffraction to the determination of the SiO_2 content of dusts is described. The internal standard method is used, the standards being known mixtures of SiO_2 and calcite with a const. proportion of fluorite. Results of tests with various dusts of known SiO_2 content indicate that the average error is ~7% when [SiO_2] is > ~3%; with lower [SiO_2] the error is somewhat greater. C. R. H.

[Detection of] silicon in steel.—See B., 1940, 673.

Determination of carbon disulphide in air.—See B., 1940, 707.

Determination of the radon and thoron content of air. C. Goodman and R. D. Evans (Physical Rev., 1938, [ii], **54**, 866).—A method of sampling and collection from air is described. Ordinary laboratory air contains $<10^{-13}$ Curie of Rn or thoron per l. The Rn content of air in Ra-dial painting plants varies from 4×10^{-12} to 25×10^{-12} Curie per l. The thoron content in Th-mantle factories ranges from 250×10^{-12} to 4400×10^{-12} Curie per l.
L. S. T.

Old and new systems for reporting the inorganic constituents in natural waters. V. G. Anderson (J. Proc. Austral. Chem. Inst., 1940, **7**, 187—212).—Two rational numerical bases of reporting results are suggested. In one, each radical in the total dry saline matter is expressed as a-%. In the other the results are expressed as ratios taking 100 equivs. of Cl′ as reference no. The limitation of these methods, which facilitate interpretation and classification, are indicated. For graphical interpretation of the analytical results polar charts, compound bar charts, or the perimetric diagram can be used. In the perimetric diagram, the mg.-equiv. concns. of Cl, SO_4, NO_3, and HCO_3 are represented by four straight lines, relatively inclined to each other and placed end to end to form half of the perimeter of the parallel solid figure, and the basic radicals along the semiperimeter of the remaining half of the figure; the HCO_3 radical is drawn horizontally to the remainder. The magnitudes are represented by lines, not areas. The shape of the diagram indicates the type of H_2O, the nature and probable origin of the dissolved salts, and composition of the probable product of evaporation. Application of these numerical and graphical methods shows that the composition of dissolved mineral matter in many Australian waters is closely related to that of sea-H_2O. O. M.

Colorimetric determination of copper with triethanolamine. J. H. Yoe and C. J. Barton (Ind. Eng. Chem. [Anal.], 1940, **12**, 456—459).—The colorimetric determination of Cu with $N([CH_2]_2{\cdot}OH)_3$ (I) has been investigated spectrophotometrically, and compared with the Cu–NH_3 method. The effects of concn. of the reagent and of NH_4, Na, and K salts on the transmission at 625 mμ. of a solution containing 100 p.p.m. of Cu˙˙ are shown graphically. Beer's law holds for Cu–NH_3 systems at 625 mμ. over a range of 0—1000 p.p.m. of Cu˙˙ for 0·3 and 2·5M-NH_3, but not for the Cu–(I) solutions over the entire useful range of [Cu˙˙]. The (I) method is slightly the more sensitive at low [Cu˙˙], and has the advantages of no odour, no loss of reagent by volatilisation, and a small reagent concn. effect.
L. S. T.

Rapid determination of copper in ferromolybdenum, calcium molybdate, etc. by α-benzoinoxime.—See B., 1940, 673.

Determination of manganese in organic material containing large amounts of calcium and chlorides.—See A., 1940, III, 780.

Weathering of igneous rocks. VII. Determination of free iron oxide. M. HARADA (J. Agric. Chem. Soc. Japan, 1940, **16**, 541—551; cf. A., 1940, I, 333).—Limonitie and hæmatitic Fe_2O_3 slowly dissolve under the influence of light in dil. aq. $H_2C_2O_4$–$K_2C_2O_4$. At first a very small amount of Fe_2O_3 dissolves and forms $K_3Fe(C_2O_4)_3$, which is then converted photochemically into $K_2Fe(C_2O_4)_2$. The latter acts as a catalyst for the dissolution of further Fe_2O_3, the reaction taking place in violet and ultraviolet light, or in the dark on warming. Methods, based on the above reactions, for the determination of free, limonitic and non-limonitic, hæmatitic and non-hæmatitic Fe_2O_3 in various earths are described. J. N. A.

Colorimetric determination of iron with salicylaldoxime. D. E. HOWE [with M. G. MELLON] (Ind. Eng. Chem. [Anal.], 1940, **12**, 448—450).—The coloured complex formed between $Fe^{\cdot\cdot\cdot}$ and salicylaldoxime has been investigated spectrophotometrically, and shown to be suitable for colorimetric determination of 0·05—10 p.p.m. of $Fe^{\cdot\cdot\cdot}$. Control of p_H is essential, and determinations are best effected at p_H 7 (NH_4OAc buffer). At this p_H, Beer's law holds over a wide concn. range, and the red-orange colour develops to a max. in 30 sec. and is stable for >24 hr. In a 30-cm. Nessler tube, the smallest amount of $Fe^{\cdot\cdot\cdot}$ detectable is 1 in 2×10^7 parts of solution. The coloured complex is not extractable from the aq. solution by EtOH, CS_2, C_6H_6, or EtOAc, and only slightly by $CHCl_3$. Cl′, Br′, CNS′, ClO_3', ClO_4', SO_4'', and OAc′ do not interfere, but tartrate, citrate, C_2O_4'', CN′, CO_3'', BO_3''', PO_4''', and excessive amounts of F′ must be absent. Colourless cations do not interfere. Details of procedure are given. L. S. T.

Identification of ferrocyanide ion. W. C. OELKE (Ind. Eng. Chem. [Anal.], 1940, **12**, 498).—To 1 drop of the test solution are added dil. HCl and 1 drop of 10% $TiCl_4$ in 1 : 1 HCl. A yellowish- or reddish-brown ppt. indicates the presence of $Fe(CN)_6''''$. $Fe(CN)_6'''$ gives no ppt. NO_2', AsO_4''', CrO_4'', and other strongly oxidising ions interfere. The limit of sensitivity is 0·05 mg. of $Fe(CN)_6''''$. L. S. T.

Colorimetric determination of cobalt with β-nitroso-α-naphthol. J. H. YOE and C. J. BARTON (Ind. Eng. Chem. [Anal.], 1940, **12**, 405—409).—The optimum conditions of measurement, the effects of salts, and the interferences due to relatively large amounts of $Ni^{\cdot\cdot}$, $Cu^{\cdot\cdot}$, $Fe^{\cdot\cdot\cdot}$, $Cr^{\cdot\cdot\cdot}$, and $Mn^{\cdot\cdot}$ have been determined by a spectrophotometric investigation of the method. The chief advantages are high sensitivity and reproducibility, and the disadvantages are the large effect of [NH_3] and the low solubility of the Co compound. For 1 p.p.m. of $Co^{\cdot\cdot}$, the probable error of the method is ±0·006 p.p.m. of $Co^{\cdot\cdot}$. The Lambert–Beer law holds for concns. of 0—1·0 p.p.m. 1 : 2-NO-$C_{10}H_6$·OH has approx. the same sensitivity, 0·005 p.p.m. (cf. A., 1920, ii, 194) as the 2 : 1-compound, and is subject to the same limitations. L. S. T.

Nitroso-R-salt method for determination of cobalt in pastures.—See B., 1940, 699.

Separation of molybdenum from tin and sulphur. D. A. LAMBIE and W. R. SCHOELLER (Analyst, 1940, **65**, 281—286).—The quant. separation of Mo as MoS from aq.-$H_2C_2O_4$ solutions containing Sn salts was unsuccessful. The MoS ppt. carried down appreciable quantities of Sn, which interfered with its subsequent determination as $PbMoO_4$. By careful definition of the conditions, separation of Sn from Mo was achieved by co-pptn. of $Sn(OH)_4$ with $Fe(OH)_3$. The boiling solution of Mo and Sn (total wt. <0·3 g.) in HCl (10 ml.) and HNO_3 (3 ml.) was treated with $FeCl_3$, diluted, and poured into hot aq. NH_3 (100 ml.). The ppt. was redissolved in HCl and the procedure repeated. The Sn is best determined as SnS_2 with subsequent ignition to SnO_2. $BaSO_4$ pptd. in the presence of MoO_4'' is heavily contaminated; Mo must be removed before determination of SO_4''. A successful procedure is described; the MoO_4'' is pptd. as $PbMoO_4$ in presence of NH_4OAc and NH_4Cl, the SO_4'' being determined in the usual way in the filtrates. E. C. B. S.

Radiation pyrometer for the measurement of low and high temperatures. J. STRONG (Physical Rev., 1938, [ii], **54**, 242).—The instrument described can be used to measure the surface temp. of solids, gases, vapours, liquids, and clouds. L. S. T.

High-pressure arc as spectroscopic source. W. W. WATSON (Physical Rev., 1938, [ii], **54**, 865).—A new high-pressure spectrum of PbH has been obtained as an example of the enhancement of the population of many discrete excited states of mols. that results when gas pressure is increased to several atm. L. S. T.

Thin quartz crystals as used in the Cauchois focussing *X*-ray spectrograph. F. R. HIRSH, jun. (Physical Rev., 1940, [ii], **58**, 78—81; cf. A., 1939, I, 64).—A discussion of the origin and characteristics of doubled *X*-ray lines formed by the Cauchois focussing spectrograph. N. M. B.

Automatic spectrograph and accessory equipment for solar spectrum photography. H. S. STEWART, jun., and B. O'BRIEN (Physical Rev., 1938, [ii], **53**, 949).—An automatic quartz spectrograph recording the ultra-violet solar spectrum on a film has been constructed. L. S. T.

Refractive indices of cellulose film. I. Determination of refractive indices of mica as a model of the cellulose film with Abbé refractometer. S. OKAJIMA (J. Soc. Chem. Ind. Japan, 1939, **42**, 381—382B).—The refractive indices of mica can be accurately determined with an Abbé refractometer, using mixtures of PhI, CH_2Ph·OBz, and CH_2Ph·OH as immersion liquids. The vals. are independent of those of the immersion liquids. W. A. R.

New electron microscope. L. MARTON (Physical Rev., 1940, [ii], **58**, 57—60).—A high-power, self-

contained instrument of the transmission type, giving a resolving power of ~50 A., is described. N. M. B.

Electron microscope for the research laboratory. V. K. ZWORYKIN (Science, 1940, **92**, 51—53).—The main features of the microscope are described and illustrated. Photographs of pathogenic bacteria obtained with it are reproduced. L. S. T.

Vacuum-tube voltmeter. Application to potentiometric precipitation titrations. L. E. WEST and R. J. ROBINSON (Ind. Eng. Chem. [Anal.], 1940, **12**, 476—479).—The modification of the Kinney–Garman (A., 1936, 955) apparatus described permits its extension to the titration of Cl′ with Ag˙, SO_4'' with Ba˙˙, and Mg˙˙ with OH′. L. S. T.

Universal p_H meter and simplified vacuum-tube electrometer. F. M. GOYAN, C. L. BARNES, and H. W. HIND (Ind. Eng. Chem. [Anal.], 1940, **12**, 485—488).—A circuit capable of transforming a potentiometer and standard cell into a direct-reading p_H meter is described. The circuit is self-calibrating, and can be used with glass, H_2, quinhydrone, or other electrode systems, and a suitable electrometer. A simplified vac.-tube electrometer is described, and typical results with various electrodes are recorded. L. S. T.

Measurement of high insulation resistance with valve electrometer. T. AKAHIRA and M. KAMAZAWA (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 537—547).—Apparatus is described in which a valve electrometer is used to measure the rate of charging of a condenser supplied with a small continuous current, and by means of which currents from 10^{-7} to 10^{-14} amp. can be measured. Resistances of Japanese amber, quartz, and ebonite have been measured. O. D. S.

Temperature-independent electrical resistances. F. HILDEBRANDT (Z. tech. Physik, 1940, **21**, 64).—The compensation of the temp. variation of electrical resistances, and the production of resistances with any desired temp. coeff., by combination with a second resistance of different temp. coeff. with or without a subsidiary current is described. O. D. S.

Application of electrometric methods in microchemistry. U. EHRHARDT (Angew. Chem., 1940, **53**, 125—128).—Apparatus and circuits adapted to working on a micro-scale are described. F. J. G.

Energy variations in a cyclotron ion beam. G. K. GREEN and P. G. KRUGER (Physical Rev., 1938, [ii], **53**, 927—928).—Energy variations in the 1-Me.v. deuteron beam from a small cyclotron are described and discussed. L. S. T.

Cyclotron magnet-current stabiliser. T. PERRY (Physical Rev., 1938, [ii], **53**, 943).—The device described maintains the cyclotron magnet current const. to $\pm 0.02\%$. L. S. T.

Automatic pipette. G. MIDDLETON (Chem. and Ind., 1940, 607—608).—The pipette described contains no ground joints and gives an accuracy ~5% in a 1- or 2-mil size and ~2½% in 5- and 10-mil sizes. L. J. J.

Automatic multiple burette. J. S. TAPP (Canad. J. Res., 1940, **18**, **B**, 217—222).—An automatic apparatus for delivering small measured quantities at regular time intervals is described. The valves comprise short pieces of rubber tubing, pinched against a wooden block by rocker arms, which are released at suitable time intervals by small cams comprising discs carrying a small machine screw. The apparatus can be used for discharging the same or different liquids from the different jets, whilst the liquid is not subject to evaporation or contamination. J. W. S.

Accurate timing equipment for viscosity determinations. E. M. FRY, jun., and E. L. BALDESCHWIELER (Ind. Eng. Chem. [Anal.], 1940, **12**, 472—473).—Method and apparatus for timing with an accuracy of $<\pm 0.1\%$ on intervals of $\not<100$ sec. are described. L. S. T.

Combustion boat tongs. H. F. PRIEST (Ind. Eng. Chem. [Anal.], 1940, **12**, 473).—The new design of tongs described holds the boat firmly and rigidly while being moved in the combustion tube, enables the position of the boat to be reproduced exactly, and expedites combustion analyses. L. S. T.

Apparatus for maintaining constant levels in a water-bath and a distilling flask. F. E. HOLMES (Ind. Eng. Chem. [Anal.], 1940, **12**, 483—485).—One of the pieces of apparatus described maintains the level of H_2O in a large bath (50 × 50 cm.) within <1 mm., and the other enables a small distilling flask to be used in the continuous distillation of a large vol. of liquid from a reservoir. L. S. T.

Distillation apparatus with plane ground joints, without bungs. C. L. PALFRAY (Document. sci., 1937, **6**, 81—82; Chem. Zentr., 1937, i, 4830). A. J. E. W.

Apparatus for Gutzeit test for arsenic.—See A., 1940, III, 778.

Spinning-band fractionating column for use with small quantities of liquids. R. H. BAKER, C. BARKENBUS, and C. A. ROSWELL (Ind. Eng. Chem. [Anal.], 1940, **12**, 468—470).—Details of construction of a 70-plate spinning-band column, which has a hold-up of 0·1 c.c. per plate, are given. L. S. T.

Suction filtration apparatus for sampling filtrates under constant pressure. E. T. FUKUNAGA and L. A. DEAN (Ind. Eng. Chem. [Anal.], 1940, **12**, 471).—The apparatus described and illustrated permits rapid removal of aliquot portions of filtrate without disconnexions or changes in pressure. L. S. T.

Concentration of isotopes by thermal diffusion: rate of approach to equilibrium. J. BARDEEN (Physical Rev., 1940, [ii], **58**, 94—95; cf. A., 1940, I, 176).—Mathematical. Additions and corrections. N. M. B.

Methods of producing gas-free surfaces. H. E. FARNSWORTH and R. P. WINCH (Physical Rev., 1938, [ii], **53**, 935).—Ag surfaces obtained by deposition in a vac. of a thin film evaporated from outgassed Ag crystals are less free from gas than those obtained directly by prolonged electron bombardment. L. S. T.

Condensation hygrometer. T. OKADA and M. TAMURA (Proc. Imp. Acad. Tokyo, 1940, **16**, 208—213; cf. A., 1940, I, 377).—Calculation of the

humidity in the new condensation hygrometer is modified by the inclusion of several small correction terms. Comparison with an Assman aspiration psycrometer shows that the instrument would be sufficiently accurate for routine meteorological observations. D. F. R.

Stopcock lubricant for use with [organic] solvents, acids, or alkalis. P. W. ROHRBAUGH (Science, 1940, **92**, 114).—Graphite forms a suitable lubricant for glass taps etc. Only a very small amount should be used. L. S. T.

Vacuum stirrer for the laboratory. J. H. READ (J.S.C.I., 1940, **59**, 218).—The apparatus has been used for the vigorous agitation of oils under high vac. at temp. up to 300°; it is vac.-tight at the pressures obtainable with a Hyvac pump, and can be run at 700 r.p.m. or more. Provision is made against loss of material by frothing. The stirrer can be used under conditions which lead to the softening and decomp. of rubber stoppers.

Preparation of Cellophane membranes of graded permeability.—See A., 1940, III, 778.

Geochemistry.

Occurrence of gallium in hot springs of Japan. K. KURODA (Bull. Chem. Soc. Japan, 1940, **15**, 234—236).—The approx. Ga content, estimated spectrographically, is recorded for 11 springs. The highest observed is 1—5 $\times$ 10^{-5} g. per l. F. L. U.

Occurrence of beryllium in hot springs of Japan. K. KURODA (Bull. Chem. Soc. Japan, 1940, **15**, 237—238; cf. A., 1939, I, 541).—Up to 5—10 $\times$ 10^{-5} g. per l. of Be has been found spectrographically in 11 springs. F. L. U.

Ground water in the Oklahoma Panhandle. S. L. SCHOFF (Econ. Geol., 1940, **35**, 534—545).—The H_2O table and the chief sources of ground H_2O are described. L. S. T.

Chemistry and hydrography of lakes Tanganyika and Nyasa. R. S. A. BEAUCHAMP (Nature, 1940, **146**, 253—256). L. S. T.

Geology and artesian water resources of a portion of the Virginia coastal plain. D. J. CEDERSTROM (Bull. Geol. Soc. Amer., 1938, **49**, 1947).—H_2O at Franklin, Courtland, Smithfield, and other points contains 2—6 p.p.m. of F' from an unknown source. L. S. T.

Deposition of calcium sulphate from sea-water. E. POSNJAK (Amer. J. Sci., 1940, **238**, 559—568; cf. A., 1939, I, 200).—Determinations of the solubilities of gypsum (I) and anhydrite (II) at 30° in solutions containing NaCl 2·72, $MgCl_2$ 0·38, $MgSO_4$ 0·17, and K_2SO_4 0·09% are recorded. The solubilities increase rapidly in presence of increasing concns. of the sea salts, reach a max. at $\sim$ twice the usual salinity of sea-H_2O, and then gradually decrease. The decrease for (II) is the more rapid, and the curves for (I) and (II) intersect at $\sim$4·8 times the usual salinity of sea-water, the point at which (II) becomes the stable phase. Sea-H_2O is unsaturated with respect to $CaSO_4$, and only after its salt content has increased by evaporation to 3·35 times the usual salinity can deposition take place. Between this concn. and that required for stable deposition of (II) nearly half of the total amount of $CaSO_4$ present in sea-H_2O will be deposited at 30° as (I). In a marine basin much of the $CaSO_4$ will be deposited as (I), and sedimentary marine deposits of pure (II) must either be derived, at least in part, from (I), or have been formed close to or above 42°, the transition point of the two minerals. L. S. T.

Constitution of the solfataric gases at Kilauea volcano, Hawaii. S. S. BALLARD (Physical Rev., 1938, [ii], **54**, 236).—The chief constituent, other than steam, is SO_2 (90% of some samples). CO_2 is present in amounts $\sim\frac{1}{12}$ of the SO_2. O_2 and N_2 are present in widely-varying amounts, but always in approx. the atm. ratio. A, but no other rare gas, is present in the N_2 residue. No significant trace of the combustible gases ordinarily associated with volcanism was detected in any sample. L. S. T.

Two new constituents of meteoritic gases. J. D. BUDDHUE (Amer. J. Sci., 1940, **238**, 569—572).—Spectrographic examination of the gases evolved by heating the stony meteorites from Holbrook, Arizona, and Washougal, Washington, show, in addition to N_2, H_2, oxides of C, and possibly the C_2 mol., the presence of $(CN)_2$ and Ne. He also occurred in the gases from the Holbrook meteorite. A was absent. The presence of $(CN)_2$ strengthens the supposed connexion between meteorites and comets. Both meteorites showed luminescence. L. S. T.

Cherts in the Karroo system. E. D. MOUNTAIN and J. J. FRANKEL (S. African J. Sci., 1939, **36**, 183—187).—Cherts from the Upper Dwyka beds, near Grahamstown, and from the Molteno beds between Jamestown and Aliwal North are described. Chemical analyses are recorded. Differences between the two cherts are ascribed to slightly different modes of origin, both being due to metasomatic alteration of shale. L. S. T.

Origin of the calcareous deposits of the Rietspruit Valley, Orange Free State. J. DE VILLIERS (S. African J. Sci., 1939, **36**, 170—175).—The Portland nodular limestone is of secondary origin, and its formation from dolerite rock is described. The Helpmekaar friable limestone resulted from the decomp. *in situ* of a thick travertine bed due to leaching, and the Rietgat pulverulent limestone from the decomp. *in situ* of a bed of nodular limestone. L. S. T.

Volcanic ash as a source of silica for the silicification of wood. K. J. MURATA (Amer. J. Sci., 1940, **238**, 586—596).—Volcanic ash is a rich source of readily-available SiO_2 for geochemical processes, and the common association of silicified wood with volcanic ash is regarded as the result of a genetic relationship arising from the alterability of the ash. Silicified wood may serve as an indicator for volcanic material in sedimentary deposits. Occurrences of

silicified wood in the United States are listed and classified. L. S. T.

Geology of the oil-field belt of S.W. Iran and Iraq. G. M. LEES and F. D. S. RICHARDSON (Geol. Mag., 1940, **77**, 227—252).—The main geological features of this belt, the mode of occurrence of the oil, and the distribution of the oil-fields are described. L. S. T.

Leucite-bearing rocks of the West Kimberley area, Western Australia. A. WADE and R. T. PRIDER (Quart. J. Geol. Soc., 1940, **96**, 39—98).—A no. of occurrences of post-Permian volcanic rocks in this district are described. They are among the richest leucite-bearing rocks yet described. Four new rock-types, fitzroyite, cedricite, mamilite, and wolgidite, are described, and their chemical analyses discussed and compared with those of similar, known types. Petrogenesis is discussed. Chemical analyses of *magnophorite*, a katophoritic amphibole, and *wadeite*, essentially a K Zr silicate, both from wolgidite, and a titaniferous phlogopite from fitzroyite, are also recorded. L. S. T.

Optical properties of fluorite in the 6 μ. region. D. WILLIAMS (Physical Rev., 1938, [ii], **53**, 930).—Coloured varieties of fluorite (I) show intense bands in this region, and even colourless varieties show weak bands. Anomalous dispersion occurs when coloured (I) is used as prism material. L. S. T.

Granites of the Front Range, Colorado: the Indian Creek plutons. M. F. BOOS and E. ABERDEEN (Bull. Geol. Soc. Amer., 1940, **51**, 697—730).—Three chemical analyses are included. L. S. T.

Association of magnesia with silica in a pure magnesium clay. P. G. NUTTING (J. Washington Acad. Sci., 1940, **30**, 233—237).—A white clay occurring near Hector, California, is a nearly pure Mg silicate of the montmorillonite type; it swells largely and disperses readily in H_2O like the familiar Wyoming bentonites. In spite of cryst. nature of the mineral, the Mg is removed completely by electro-dialysis, leaving pure SiO_2. In hot acid solutions, this clay breaks down like the Wyoming bentonite, but at much lower acid concns. Solubility data in dil. HCl are tabulated. A p_H study of the clay–acid equilibrium filtrates indicates that $H^{\cdot}$ are inactivated either by physical adsorption or chemical reaction, or that OH' are released over a certain range. L. S. T.

Movement of potassium in irrigated and fertilised red sandy clay. D. LACHOWER (J. Agric. Sci., 1940, **30**, 498—502).—Addition of K_2SO_4 increases sol., exchangeable and non-exchangeable K. Increased irrigation carries K into lower soil layers and increases loss by leaching. In the absence of irrigation K ascends in soil in summer and sinks in winter. R. L. E.

Hydration mechanism of the clay mineral montmorillonite saturated with various cations. S. B. HENDRICKS, R. A. NELSON, and L. T. ALEXANDER (J. Amer. Chem. Soc., 1940, **62**, 1457—1464).—The absorption of H_2O by the Li, Na, K, Cs, Mg, Ca, Sr, and Ba derivatives of montmorillonite and of the free acid has been measured in air of R.H. 5—90%, and is discussed in relation to the changes in the *X*-ray spectra. The exchangeable cations are located between the silicate layers of the mineral. In the Mg, Ca, Sr, and Ba derivatives the initial stage of H_2O absorption involves hydration of the cation with 6 mols. of H_2O. This is followed by completion of a H_2O layer of hexagonal type structure, whilst a second layer, of similar structure, is taken up at high R.H. Only 3 H_2O mols. are required for hydration of the Li ion, whilst the Na, K, Cs, and H ions are not hydrated. J. W. S.

Colour reactions between clays and amines. E. A. HAUSER and M. B. LEGGETT (J. Amer. Chem. Soc., 1940, **62**, 1811—1814).—Aromatic amines give colour reactions with clays. The colours result on grinding the dry solids, or directly on contact between clay and liquid or dissolved amine. Aliphatic and saturated cyclic amines give no reaction. Substituents alter the colour, and this is discussed in detail, as also are the effects of oxidising and reducing agents. It is suggested that the cause of the phenomenon is co-ordination between the N of the amine and an unsaturated metallic atom of the clay, resulting in resonance in the aromatic nucleus. F. J. G.

Specific gravities of clays. V. L. BOSAZZA (S. African J. Sci., 1939, **36**, 155—157).—The sp. gr. of refractory and other clays of the Witwatersrand area and of clays from the Eastern Province are tabulated and discussed. In certain cases, the vals. differ with the liquid used, viz., CCl_4, EtOH, or H_2O. L. S. T.

Constitution and classification of the clay minerals. J. S. HOSKING (J. Proc. Austral. Chem. Inst., 1940, **7**, 234—250).—A review.

Effect of heat on the clay minerals illite and montmorillonite. R. E. GRIM and W. F. BRADLEY (J. Amer. Ceram. Soc., 1940, **23**, 242—248).—*X*-Ray and optical examinations were made on three purified illites, a purified montmorillonite (I), and a natural clay [containing (I), quartz, and limonite] after heating at successive temp. up to 1400°. Illite loses H_2O from its lattice at 350—600° and its characteristic lattice is destroyed at 800—850°. At 850° a spinel phase appears and increases in quantity up to 1100—1200°. The spinel appears to form from the middle lattice plane (containing Al_2O_3, MgO, and Fe_2O_3), whilst the outer planes form an amorphous glass (950°). Mullite (II) appears at 1100° and persists to 1400°, whilst at 1300° the spinel dissolves in the glass. The quartz dissolves in the glass at 1050°. (I) loses H_2O at 500—600° and the destruction of the characteristic lattice is complete at 800—850°. A new spinel phase develops at 850° and increases in quantity up to 1100°. (II) forms in increasing quantity at >850° and at 1300° all the spinel dissolves in the glass. Whilst the lattice planes are destroyed in the same way as those of illite, the outer planes of the former provide some SiO_2 which inverts to cristobalite before dissolving in the glass at 1300°. J. A. S.

Elkonite, a colloidal clay. M. L. TAINTER, G. KULCHAR, and A. B. STOCKTON (J. Amer. Pharm. Assoc., 1940, **29**, 306—310).—Elkonite, a naturally occurring clay (H_2O 12·83, SiO_2 52·7, Fe_2O_3 1·96, Al_2O_3 17·44, CaO 0·91, MgO 3·63%), is hydrophilic

and forms a gel at concn. of 15% in H_2O. The absorptive power and other physico-chemical characteristics indicate its possible use in gastro-intestinal disorders and as an ointment base.
F. O. H.

Minor elements in sphalerite. R. E. STOIBER (Econ. Geol., 1940, **35**, 501—519).—The spectrographic analyses recorded for sphalerite (I) from numerous, diverse localities show that the variations in minor element content can be correlated with two geological factors, viz., the temp. type of the (I) deposit, and the metallogenetic province represented. Sb, Hg, Tl, and As are restricted largely to (I) from low-temp. mineral deposits, and Mo to (I) from mesothermal deposits. [Mn] is greatest in (I) from high-temp. occurrences, In in that from mesothermal deposits, and Ga and Ge increase with decreasing temp. of deposition. The largest concns. of Sn and Cd appear to be most common in (I) from deposits of other than low-temp. type. Mississippi Valley deposits, European Zn ores of Mississippi Valley type, and barite deposits of Central Kentucky are all of low-temp. origin, and (I) from each of these metallogenetic regions contains minor elements of distinctive kind and amount. L. S. T.

High-temperature, intermediate-pressure molybdenite deposit at Rencontre East, Newfoundland. D. E. WHITE and E. SAMPSON (Econ. Geol., 1939, **34**, 133).—Molybdenite (I) ore occurs in the aplite along part of the margin of a large granite batholith. In the ore zone quartz (II), muscovite (III), (I), fluorite, and minor chlorite with magnetite have replaced aplite. (II)- and (III)-rich rocks are distinctive. (I) generally favours muscovitised rock. Mineralising solutions appear to have penetrated the aplite intimately without marked structural control.
L. S. T.

Vein solutions and rock alteration in the Boulder Co. tungsten district of Colorado. T. S. LOVERING (Econ. Geol., 1939, **34**, 132—133).—Zones of minerals apparent in the alteration of oligoclase granite as a ferberite (I) vein is approached are described. The vein filling consists of (I) and many generations of fine-grained quartz carrying minor amounts of ankerite, alunite, clay minerals, etc. The succession of minerals and their character indicate acid sulphate solutions passing through the vein fissures for a long period, and a shift toward alkaline solutions when the (I) was deposited. L. S. T.

Aikinite and silver enrichment at the St. Louis mine, Butte Co., Idaho. A. L. ANDERSON (Econ. Geol., 1940, **35**, 520—533).—The occurrence of abundant amounts of the rare mineral aikinite (I) ($Cu_2S,2PbS,Bi_2S_3$) with a high Ag content is described. The Ag content resulted from selective replacement of the (I) by supergene argentite and native Ag.
L. S. T.

Ore deposits at Camp Albion, Boulder Co., Colorado. E. E. WAHLSTROM (Econ. Geol., 1940, **35**, 477—500).—The ores consist of argentiferous galena, tetradymite, pyrite, chalcopyrite, sphalerite, magnetite, and molybdenite in a gangue of soda pyroxene, soda asbestos, coarsely cryst. quartz, calcite, felspar, and fluorite. The minerals are described, and three chemical analyses recorded. Paragenesis is discussed. L. S. T.

Thermal conductivity of rocks and its dependence on temperature and composition. I, II. F. BIRCH and H. CLARK (Amer. J. Sci., 1940, **238**, 529—558, 613—635).—Apparatus for measuring abs. thermal conductivity between 0° and 500° is described. Results for 18 igneous and 7 sedimentary and metamorphic rocks, single crystals of quartz, calcite, and halite, and four glasses are recorded, and discussed in the light of theories of heat conduction in crystals. At 0°, the conductivities of all the rocks lie between 0·014 and 0·004 g.-cal. per cm. per sec. per degree, and at 200°, between 0·009 and 0·004. The conductivities of the poorest conductors, the glasses and the felspar aggregates, increase with a rise in temp., but those of the other cryst. materials decrease. The ultrabasic rocks are the aggregates with the highest conductivities. A method of accounting for the conductivities of fresh igneous rocks in terms of their mineral compositions and the measured conductivities of approx. monomineral aggregates is given. L. S. T.

Thermal conductivity of some sedimentary rocks. C. D. NIVEN (Canad. J. Res., 1940, **18, A**, 132—137).—The thermal conductivities of Canadian marbles, limestones, and slate have been determined at 240—700° F., the results being of the same order as found by other investigators. Since in each case the conductivity is lower after heating, it is inferred that the measurements cannot be applied to the conductivity of sedimentary rocks in the earth. J. W. S.

Spontaneous rock expansion. G. W. BAIN (Bull. Geol. Soc. Amer., 1938, **49**, 1864).—Highly-folded rock in quarries, mines, and foundation excavations expands spontaneously when free space is provided. Rock pressures up to 1500 kg. per sq. cm. at <50 ft. depth are exerted. Expansion is due to compression when the rock was folded. L. S. T.

Origin of talc and soapstone deposits of Virginia. J. D. BURFOOT, jun. (Bull. Geol. Soc. Amer., 1938, **49**, 1946).—A discussion. L. S. T.

Nickel deposit near Gold Hill, Colorado. E. N. GODDARD and T. S. LOVERING (Econ. Geol., 1939, **34**, 131).—The deposit occurs in highly metamorphosed sediments of the Idaho Springs formation. Disseminated intergrowths of pyrite, pyrrhotite, chalcopyrite, pentlandite, and niccolite have replaced amphibole in the more calcic beds of a CaO–silicate layer in this formation. The primary ore yields Ni 0·41—6, Co 0—0·60%, and small amounts of Cu. Supergene ore contains Ni 1·32—13·02, Co 0·22—6·22, and Cu 0·05—31·60%. L. S. T.

Rock alteration in the Uchi gold area, Ontario. J. D. BATEMAN (Econ. Geol., 1940, **35**, 382—404).—A genetic relationship between granitic intrusion and Au deposition is proposed for this area. Intrusion of the younger granite, introduction of dyke rocks, mineralisation, and wall rock alteration are all related parts of a sequence of events connected with a single period of magmatic activity. Chemical analyses [W. F. GREEN] are recorded. L. S. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

NOVEMBER, 1940.

Arc spectrum of ytterbium between 2200 and 5000 A. for 2×10^{-4}, 2×10^{-5}, 2×10^{-6}, 2×10^{-7}, and 2×10^{-8} g. J. M. López de Azcona (Anal. Fís. Quím., 1940, **36**, 72—75).—In mixtures of $Yb_2(SO_4)_3,8H_2O$ with Hg_2O, Yb can be identified by the 3289·37 A. line at a concn. of 2×10^{-8} g. and by 2891·38 A. at 2×10^{-7} g. Analogous data on other Yb lines are recorded for concns. of 2×10^{-6}, 2×10^{-5}, and 2×10^{-4} g. F. R. G.

Spectrum of *RW* Hydrae. P. Swings and O. Struve (Proc. Nat. Acad. Sci., 1940, **26**, 458—461).—53 sharp emission lines, belonging mainly to H, He I, and O III series, have been identified between 3266 and 6563 A. The variable consists of a late-type component of spectral class *M*0 or late *K* with radial velocity +15 km. per sec., and a highly excited companion with radial velocity +14 km. per sec. giving Balmer lines to H_{22} with a continuum to 3300 A. and the He and O lines. Weak O II, Si I, and Ca II lines and fairly strong He II and Ne III lines are also observed. L. J. J.

Impact broadening of spectral lines. L. Spitzer, jun. (Physical Rev., 1940, [ii], **58**, 348—357; cf. A., 1939, I, 501).—Mathematical. It is shown that the combined errors introduced into current impact broadening theory by the assumption of the incorrect adiabatic approximation and by neglect of the rotation of the adiabatic electron states have fortuitously led to approx. true results. A correct treatment of these effects is developed by taking as electronic states the eigenfunctions in a non-rotating, stationary co-ordinate system. N. M. B.

Zeeman effect in krypton and xenon. J. B. Green, D. W. Bowman, and E. H. Hurlburt (Physical Rev., 1940, [ii], **58**, 381).—Discrepancies and agreements between experimental and theoretical *g* vals. resulting from measurements of the Zeeman effect of ~150 lines in the spectrum of Kr I and about the same no. in Xe I are discussed. N. M. B.

What we have learned from scattered *X*-rays. A. H. Compton (J. Franklin Inst., 1940, **230**, 149—157).—Franklin medallist's address on the history and significance of 20 years' investigations of *X*-ray scattering. W. R. A.

Reduction of breakdown potential at high frequency. H. Böcker (Arch. Elektrotech., 1937, **31**, 166—179; Chem. Zentr., 1937, i, 4606).—The breakdown potential (*E*) in a gas discharge tube falls as the frequency (ν) of the a.c. increases above a crit. val. Expressions derived for ΔE in terms of ν agree with experimental data. A. J. E. W.

Multiple scattering of fast electrons and α-particles, and "curvature" of cloud tracks due to scattering. E. J. Williams (Physical Rev., 1940, [ii], **58**, 292—306).—Mathematical. A revision of the theory of multiple scattering (cf. A., 1939, I, 291) indicates that observed discrepancies must be due to experimental error or to a failure of the basic collision theory. Previous theoretical results are extended to a theory of the multiple scattering of α-particles and recent views are examined (cf. Sheppard, A., 1940, I, 185; Goudsmit, *ibid.*, 89). N. M. B.

Polarisation of electrons by double scattering. C. B. O. Mohr and H. S. W. Massey (Nature, 1940, **146**, 264).—Polarisation effects arising from scattering by the at. fields of Au, Xe, and Kr, *i.e.*, screened Coulomb fields, have been investigated for a wide range of electron energies (100—150,000 e.v.). In the energy range covered by Mott's calculations for the unscreened field of the Au nucleus, introduction of screening has no important influence, and the failure to obtain the predicted asymmetry remains unexplained. In scattering by Au, the effect of screening makes possible the existence of large polarisation in small energy ranges at low energies. The spherical potential well also gives rise to polarisation effects, which tend to occur in narrower energy regions than for a Coulomb field. L. S. T.

Electric quadrupole moment of the deuteron. A. Nordsieck (Physical Rev., 1940, [ii], **58**, 310—315).—Mathematical. The gradient of the electric field at the nucleus in the H_2 mol. is calc. from a new electronic wave-function which gives a simple but accurate formula for the electron density. The calc. field gradient, with the mol. beam measurements of Kellog (cf. A., 1940, I, 275), confirms (±2%) the val. $2·73 \times 10^{-27}$ sq. cm. for the electric quadrupole moment of the deuteron. N. M. B.

Scattering of thermal neutrons by crystals. F. Rasetti (Physical Rev., 1940, [ii], **58**, 321—325; cf. Whitaker, A., 1940, I, 186).—The effect of crystal interference on the scattering coeff. for thermal neutrons was investigated under various conditions. Calcite shows a large interference effect, the effective mol. cross-section for scattering by a single crystal being ~⅓ that for a microcryst. aggregate. A single crystal becomes more transparent when the velocity of the neutrons is decreased. Measurements for Bi and P, where the difference is less pronounced, are given. Mass scattering coeffs. for Pb are: solid 0·028±0·002, liquid 0·027±0·002, single crystal 0·0213±0·001, microcryst. 0·0275±0·001; and for Bi: single crystal 0·019±0·001, liquid 0·024±

0·002, single crystal at 300° K. 0·0184±0·0005, at 80° K., 0·0171±0·0005. N. M. B.

Photographic plate spectrum of *d–d* neutrons. H. T. RICHARDS and E. HUDSPETH (Physical Rev., 1940, [ii], **58**, 382; cf. A., 1940, I, 307).—Magnetically analysed 700-kv. deuterons fell on a heavy paraffin target ~20 kv. thick for 1 μ-amp. hr. An analysis of photographic plates 12 cm. from the target at 0° and 90° to the bombarding beam shows no evidence of a short-range group of recoils. It is concluded that the radiative capture cross-section is $\not>$0·01 of the scattering cross-section for 2·5-Me.v. neutrons, and that there is only a single group of neutrons, and no low-energy group of neutrons, from the *d–d* reaction. N. M. B.

Reactions of high-energy atoms produced by slow-neutron capture. W. F. LIBBY (J. Amer. Chem. Soc., 1940, **62**, 1930—1943).—Capture of slow neutrons by most nuclei leads to emission of γ-ray quanta followed by β-radioactivity and recoil of the emitting nucleus. The radioactive fragment will react with surrounding mols. and non-radioactive fragments in either of two ways: (*a*) requiring, (*b*) not requiring, a certain fraction of the recoil energy. These are termed respectively activated and thermal reactions. MnO_4' ions in solution yield $Mn^*O_3^{\cdot}$ (principally), $Mn^*O_2^{\cdot\cdot\cdot}$, $Mn^*O^{\cdot\cdot\cdot\cdot\cdot}$, and $Mn^{*\cdot\cdot\cdot\cdot\cdot\cdot\cdot}$ ions all of which in neutral or acid solutions oxidise H_2O readily, and in alkaline solution combine with OH′ to form MnO_4'. In solutions of low p_H the interchange $Mn^*O_3^{\cdot} + MnO_4' = MnO_3^{\cdot} + Mn^*O_4'$ occurs. Data for solid $KMnO_4$ are also discussed. MnO_4' and MnO_4'' readily interchange an electron (probably 3*d*). P^V, As^{III}, and As^V mols. and ions, and ClO_3', BrO_3', IO_3', and ClO_4' ions, have also been similarly investigated. The recoils from P^V mols. and ions appear to eject oxidised O_2 leaving, about half the time, P^{III} and retaining ~50% activity. As^{III} and As^V expel −2 bivalent O_2 and the retention is 100%. Halogenate ions are reduced by ejection of −1 or at. O, and they also interchange with mol. halogen in acid solution, the rates of interchange being Cl < Br < I. The ClO_4' ion, however, does not rapidly interchange with Cl_2. Retention by org. halides and the effect of dilution on retention by these compounds have also been investigated. W. R. A.

β-Radiation from ^{27}Si and ^{30}P. W. H. BARKAS, E. C. CREUTZ, L. A. DELSASSO, R. B. SUTTON, and M. G. WHITE (Physical Rev., 1940, [ii], **58**, 383).—From the momentum spectra obtained in an alcohol–air-filled cloud chamber the upper limits of the positrons from ^{27}Si, formed by the reaction ^{27}Al (p, n) ^{27}Si, and from ^{30}P, formed by the reaction ^{30}Si (p, n) ^{30}P, were found to be 3·54±0·1 and 3·0±0·1 Me.v., respectively. The former val. is slightly > the 3·4 Me.v. expected on the basis of a nuclear vol. $\propto$ the mass no. (cf. A., 1939, I, 592). N. M. B.

Fission products and induced β-ray radioactivity of uranium by fast neutrons. T. YASAKI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 457—472).—The fission products obtained from U when U_3O_8 is irradiated with fast neutrons are: $^{112}_{46}$Pd (26 min.; 17 hr.); $^{111}_{47}$Ag (7·5 days), $^{112}_{47}$Ag (3·5 hr.); $^{115}_{48}$Cd (56 hr.), $^{117}_{48}$Cd (3 hr.), $^{?}_{48}$Cd (50 min.); $^{115}_{49}$In* (4·5 hr.), $^{117}_{49}$In (2 hr.). A method for their separation is described. Irradiation by fast neutrons induces β-activity in U. W. R. A.

Determination of the mean number of neutrons set free in the splitting of a uranium nucleus. H. BRADT (Helv. Phys. Acta, 1939, **12**, 553—558).—The mean no. of neutrons set free in U fission was found, by the method of Fermi (Ric. Sci., 1936, **72**, 13), to be $2{\cdot}9_5$±0·5. O. D. S.

Observation of showers and nuclear transmutation with cosmic rays in an ionisation chamber. H. EULER (Naturwiss., 1940, **28**, 141—142).—To discover whether the smaller collisions in an uncovered chamber are nuclear transmutations the effect of pressure can be investigated. Another method is to determine the frequency of simultaneous ionisation collisions in two adjacent uncovered chambers. The effect of nuclear transmutations is to give rise to a sudden increase in the slope of the collision distribution curve. A. J. M.

Absorption of cosmic rays in thick layers. I. Absorption experiments with iron. K. ALEXOPOULOS (Praktika, 1936, **11**, 398—404; Chem. Zentr., 1937, i, 4735).—Triple-coincidence counter measurements are used to test Auger's view that the mass absorption coeff. (*k*) for hard cosmic radiation is independent of the at. no. of the absorbing element. *k* for Fe is $0{\cdot}9 \times 10^{-3}$ g.$^{-1}$ cm.^{2} A. J. E. W.

Time-variations in cosmic-ray intensity at high altitudes. W. P. JESSE (Physical Rev., 1940, [ii], **58**, 281—287; cf. A., 1940, I, 189).—Balloon flight observations over a year show marked intensity changes, with a max. variation of ~14% for the peak val. of the ionisation–pressure curve. After correction for the "world-wide" variations at ground stations, the residual variations show a max. in the early spring, falling to lower vals. in the summer, and increasing in the autumn, with some indication of relations to magnetic changes. N. M. B.

Fine structure in the directional intensity of cosmic rays. D. COOPER (Physical Rev., 1940, [ii], **58**, 288—292; cf. A., 1939, I, 445).—Using a triple-coincidence circuit of counters, an investigation of fine structure in the zenith-angle distribution of cosmic-ray intensity in the zenith-angle range 0—45° for various directions shows intensity patterns with small oscillations. The prominences measured in terms of the largest positive deviations from the $\cos^2\theta$ curve are ~2—3% of the intensity, and occur at ~7°, 20°, and 37°. The directional intensity pattern shows an approx. symmetry about the zenith. Results tend to confirm Schremp's fine-structure predictions (cf. A., 1940, I, 188). N. M. B.

Absorption of heavy corpuscles. Ş. ŢIŢEICA (Bull. Soc. Roum. Phys., 1936, **37**, No. 65, 3—13; Chem. Zentr., 1937, i, 3763; cf. Z. Physik, 1936, **101**, 378—397).—Thomas–Fermi statistics show that the mean excitation energy of an atom (at. no. *Z*), on which its scattering power depends, is *kZ*. The calc. val. of *k* is 9·5 (±40%), in agreement with experiment. A. J. E. W.

Statistical mechanics of co-operative phenomena. J. G. KIRKWOOD (J. Chem. Physics, 1940,

8, 623—627).—Mathematical. Using local free energies, a direct method of successive approximation to the configurational partition function has been developed. W. R. A.

Spin-orbit coupling in ^{5}He. S. M. DANCOFF (Physical Rev., 1940, [ii], **58**, 326—331).—Mathematical. Experimental results on the splitting of the ground state of ^{5}He (cf. Staub, A., 1940, I, 307) are compared with the structures expected on the basis of Thomas relativistic spin-orbit coupling and of tensor spin-orbit interaction of mesotron theory. The former gives an unsatisfactory result, and the latter a result of the same order of magnitude as the experimental splitting and of the " normal " structure. N. M. B.

Superconductivity. K. R. DIXIT (Current Sci., 1940, **9**, 274—275).—If interaction between lattice and conductivity electrons becomes negligible at a very low temp., superconductivity will ensue and the conductivity electrons will precess in a magnetic field, giving a diamagnetic susceptibility of $\sim 1/4\pi$. Observed finite vals. of superconductivity may be due to the small second-order interaction between nuclear and electron spins which is responsible for the hyperfine structure of spectral lines. L. J. J.

λ 3105, λ 3338, and λ 3375 bands of OD. M. ISHAQ (Current Sci., 1940, **9**, 275—276).—Rotational consts. of OD are recorded and compared with those of OH. The structure is characteristic of a $^2\Sigma \rightarrow {}^2\Pi_{inv.}$ transition. L. J. J.

Nuclear isotope shift in the spectra of HgH^+ and HgD^+. S. MROZOWSKI (Physical Rev., 1940, [ii], **58**, 332—340; cf. A., 1940, I, 138).—Lines in the band spectra of HgH^+ and HgD^+ excited in a hollow-cathode tube and studied with Fabry–Perot etalons show broadening with traces of structure due to isotopic effect. There is no anomalous behaviour of components belonging to the odd Hg isotopes due to hyperfine splitting, but the half-widths differ widely from those expected. From the measured half-widths the shifts between consecutive even isotopes are evaluated and compared with those calc. from isotope effect. The differences represent the additional shifts which must be explained as nuclear isotope shifts. Consideration of the data on the nuclear isotope shifts in HgH, HgH^+, Hg I, and Hg II leads to conclusions on the deformation of the electron clouds in Hg and Hg^+ caused by the attachment of H, and a rough calculation of the nuclear shifts in the mol. levels of of HgH and HgH^+. N. M. B.

Estimation of ground state dissociation energies of di-atoms of symmetrical molecular groups. C. H. D. CLARK (Proc. Leeds Phil. Soc., Sci. Sect., 1940, **3**, 597—602).—Two relationships, formerly applied to the fundamental vibration frequencies of di-atoms of symmetrical mol. groups (*e.g.*, LiLi, NaNa, etc.), have been considered with a view to their application to the estimation of dissociation energies of di-atoms. The expressions are: (1) $\log D = p - n \log 2Z$ (D = dissociation energy; p, n are group consts. of the di-atoms, and Z is at. no.); (2) $a^n = kbc^{n-1}$ (a, b, c are ground dissociation energies of the di-atoms XY, XX, and YY). Results obtained from both relationships agree satisfactorily with experiment, and with those obtained formerly by the use of an independent empirical equation. A. J. M.

Spectrum of P_2 molecule. G. HERZBERG, L. HERZBERG, and G. G. MILNE (Canad. J. Res., 1940, **18**, **A**, 139—143).—Five bands of the ultra-violet system of P_2, with low v' and v'' vals., have been analysed and the following vals. determined with a greater accuracy than previously possible: rotational consts. B_e'' and α_e'', 0·3031 and 0·00138 cm.$^{-1}$; moment of inertia, I_e'', 92·36 × 10^{-40} g.-cm.^{2}; internuclear distance, r_e'', 1·895 × 10^{-8} cm. D. F. R.

Absorption spectra of indium chloride, indium bromide, indium iodide, and gallium chloride in the Schumann region. M. WEHRLI and W. WENK (Helv. Phys. Acta, 1939, **12**, 559—560).—Between 1580 and 5000 A. $InCl_2$, $InBr_2$, InI_2, and $GaCl_2$ show four regions of continuous absorption the positions of which shift towards the red on passing from $InCl_2$ through $InBr_2$ to InI_2. InCl and InBr decompose photochemically in this region to an excited halogen atom and an excited, ^2S, In atom which emits the lines at 4511 and 4102 A. O. D. S.

Ultra-violet absorption of cobalt salts and some light filters for the ultra-violet region. H. L. J. BÄCKSTRÖM (Arkiv Kemi, Min., Geol., 1940, **13**, **A**, No. 24, 16 pp.).—Aq. solutions of pure $CoSO_4$ and of $NiSO_4$ have a high degree of transparency for ultra-violet. The transparency is considerably decreased by impurities. Mixed conc. aq. solutions of the two salts may be used as filters for the ultra-violet, transmitting λλ 220—340 mμ. more or less completely, and absorbing longer λλ. By combining these filters with supplementary ones it is possible to isolate definite λλ. A method for preparing the pure salts from the commercial products is described. A. J. M.

Investigation of hydrogen bonds by infra-red absorption spectra. G. B. B. M. SUTHERLAND (Trans. Faraday Soc., 1940, **36**, 889—897).—The interpretation and the theoretical basis of modifications in the vibration frequency of X–H bonds caused by various types of association are discussed. F. L. U.

Infra-red absorption of the hydroxyl group in relation to inter- and intra-molecular hydrogen bonds. J. J. FOX and A. E. MARTIN (Trans. Faraday Soc., 1940, **36**, 897—911).—In dil. CCl_4 solution the O–H band of $CH_2Ph·OH$ has components at 2·750 and 2·765 μ., probably denoting two slightly different mol. species of the monomeride. The extinction coeff. remains const. over the range 0·0005—0·03 mol. per l. At 0·067 and 0·170 mol. per l. equilibrium subsists between monomeric and dimeric (2·865 μ.) mols., and at higher concns. further polymerisation occurs, probably with the formation of a tetrameride. The position (~3 μ.) and intensity of the absorption due to the polymerides are very similar for the more conc. solution and the pure liquid. A sharp band at 2·776 μ. is attributed to a slight modification of the free OH present in the dimeride. An attempt is made to clarify the expression " energy of the H bond." F. L. U.

Spectra and molecular vibrations of glyoxal. H. W. THOMPSON (Trans. Faraday Soc., 1940, **36**, 988—999).—The ultra-violet and infra-red (1—15 μ.) absorption spectra of $(CHO)_2$ vapour have been measured. Analysis of the data does not permit an unambiguous decision between the possible mol. structures, but does not exclude the planar *trans* structure for which some evidence exists (cf. Lu Valle and Schomaker, A., 1940, I, 101). The fluorescence spectrum excited by λλ 4047 and 4358 A. has been measured and correlated with the absorption spectrum. F. L. U.

Infra-red absorption studies of some hydrocarbons. F. T. WALL and G. W. MCMILLAN (J. Amer. Chem. Soc., 1940, **62**, 2225—2227).—The infra-red absorption spectra of C_6H_6, Ph_2, $C_{10}H_8$, anthracene, phenanthrene, indene, hydrindene, tetrahydronaphthalene, 9 : 10-dihydro- and *cis-as*-octahydrophenanthrene in CCl_4 have been investigated from 3·2 to 3·5 μ. The "aromatic" part of the mol. gives rise to bands at 3·2—3·3 μ., whilst the "aliphatic" gives bands in the region 3·45 μ. Hooke's law force consts. for the different kinds of C–H bonds have been evaluated. W. R. A.

Infra-red absorptions of organic hydroxyl compounds in the solid state in the 3 μ. region. M. M. DAVIES (J. Chem. Physics, 1940, **8**, 577—587).—The absorption of thin films of various org. solids in the region 2·6 to 3·5 μ. has been investigated. Cetyl alcohol shows CH absorption at 3·4—3·5 μ. but the associational band is shifted by ~0·1 μ. to longer λλ, indicating increased association of OH groups. Lauric acid and ω-hydroxyhexadecoic acid also give absorption curves indicative of enhanced association. The OH band of solid $CPh_3 \cdot OH$ (I) has a doublet structure near 2·90 μ. with a frequency difference of 42 $cm.^{-1}$ between the two components, whereas in solution it is single and not so broad. The occurrence of a doublet OH peak is also established in solid mandelic (II) and α-hydroxymyristic (III) acids and Δν is ≃ that found for (I). The absorptions of CCl_4 solutions of (II) and (III) have also been investigated in the same region. $OH \cdot CHPh \cdot CO_2Et$ has been studied as a solid, as a liquid, and in CCl_4 solution; there is a gradual transition from dil. solution to solid. Other compounds studied are: Et β-hydroxy-β-phenyl-β-diphenylylpropionate (solid and in CCl_4), *cis-* and *trans*-Me 9 : 10-dihydroxystearates (solid and in CCl_4), and solid pyrocatechol, resorcinol, quinol, and quinhydrone. Those mols. which show a narrow doublet structure near 2·90 μ. possess relatively "free" OH groups resulting from steric protection or from weak intramol. binding. W. R. A.

Rottlerin. VI. Spectrographic study of rottlerin and its derivatives. R. A. MORTON and Z. SAWIRES (J.C.S., 1940, 1052—1064).—The absorption spectra of rottlerin, *iso*rottlerin, and many derivatives have been measured; they are mainly determined by those of methylphloracetophenone. If the Ac group is replaced by CHPh:CH·CO, a new factor enters into the spectra and there is a less important effect when chromen structures occur. There is qualitatively a predominant additive effect in the spectra, but constitutive effects are more significant for intensities of absorption. A large no. of relatively simple substances have been examined, and the data used in an extended correlation between structure and absorption. The Me ethers give rise to interesting anomalies having rather wide implications. F. R. S.

Ultra-violet absorption spectra of nitrogenous heterocyclic compounds. II. Effect of p_H and irradiation on the spectrum of barbituric acid. J. R. LOOFBOUROW and (MISS) M. M. STIMSON (J.C.S., 1940, 1275—1277).—The triketonic form of barbituric acid (I), $CO{<}{}^{NH\cdot CO}_{NH\cdot CO}{>}CH_2$, can give three mono-enolic forms, five di-enolic forms, and the tri-enolic form $OH\cdot C{\lessgtr}{}^{N:C(OH)}_{N\cdot C(OH)}{\gtrless}CH$, which would predominate in alkaline solution. The spectrum should, therefore, show distinct changes with p_H on account of $:NH\cdot CO\cdot \rightleftharpoons \cdot N:C(OH)\cdot$ tautomerism and the changes which are observed can be accounted for on this theory. Ultra-violet irradiation of (I) in unbuffered solution at p_H 4·6 gave marked progressive decrease in extinction. W. R. A.

Change of ultra-violet transparency of glass with temperature.—See B., 1940, 736.

Crystallo-chemical studies in spinel luminophors; system magnesium orthotitanate–manganese. E. TIEDE and E. VILLAIN (Ber., 1940, **73**, [*B*], 274—279).—Phosphors prepared by heating $2MgO + TiO_2$ with traces of Fe, Mn, Cu, Cr, Ag, Ni, Co, Re, Bi, Au, Zn, Nb, In, W, or U for 20 min. at 1200° have been examined. Only those containing Mn show luminescence in ultra-violet light, although the Cr phosphors luminesce in cathode rays. Emission from the Mn phosphors is confined to a narrow band of the spectrum with a max. at ~6550 A. (exciting light 3100—4000 A.). The optimum [Mn] is 0·5 mg. per g. of Mg_2TiO_4. Luminescence occurs only with Mg_2TiO_4 as base, as preps. from $MgO + 2TiO_2$ and $MgO + TiO_2$ give no effect with Mn. KCl is effectively used as a mineraliser in the heating process (1100°). The luminescence is improved by slow cooling and by heating the phosphors in O_2, but destroyed by heating in N_2. Relatively large amounts of Fe, Ni, and Cu also inhibit luminescence, and pressure has a slight inhibiting effect. Excitation occurs at −190° to 30°, but at >100° the intensity is diminished. The spinel structure of the phosphors is confirmed by *X*-ray powder diagrams. A. J. E. W.

Raman and infra-red spectra of α-quartz. B. D. SAKSENA (Proc. Indian Acad. Sci., 1940, **12, A**, 93—139).—From known crystal data for α-quartz and the character table for the relevant point group, the symmetry modes of vibration of atoms in the unit cell, selection rules, polarisation and intensity of lines, and their appearance in Raman and infra-red absorption spectra are deduced. Experimental results, using polarised and unpolarised excitation at different crystal orientations, are given and compared with recorded data and theoretical predictions. The sp. heat of α-quartz has been calc. from 23° to 808° K. from the spectroscopic analysis and is in complete agreement with experimental data. W. R. A.

Raman spectrum of aluminium bromide. E. J. Rosenbaum (J. Chem. Physics, 1940, **8**, 643).—The Raman spectrum of liquid Al_2Br_6 at 100° consists of 5 strong and 4 weak lines. Possible models are discussed but no definite conclusions can be drawn from the data. W. R. A.

Ionisation and dissociation of water vapour and ammonia by electron impact. M. M. Mann, A. Hustrulid, and J. T. Tate (Physical Rev., 1940, [ii], **58**, 340—347).—From a mass-spectrometric study, data for the ions, intensities, appearance potentials, and processes are reported and discussed. The ionisation potential of H_2O is 13·0±0·2 v., and of NH_3 10·5±0·1 v. Ions observed in H_2O vapour are H_2O^+, OH^+, O^+, H^+, H_2^+, H_3O^+, O^-, and H^-. Ions observed in NH_3 are NH_3^+, NH_2^+, NH^+. N^+, H^+, NH_3^{++}, NH_2^-, and H^-. N. M. B.

Energy states of valency electrons in some metals. I. 4₁. Nature of the electrode potential of zinc and hydrogen and the mechanism of catalytic action of metal surface (revisions). M. Satô (Sci. Rep. Tôhoku, 1940, **29**, 87—112).—Vals. of the normal electrode potentials of the (0001), (10$\bar{1}$0), (11$\bar{2}$0), (10$\bar{1}$1), and (11$\bar{2}$1) surfaces of the Zn crystal in H_2SO_4 and $ZnSO_4$ solutions are corr. (cf. A., 1937, I, 414). An explanation of the photoelectric properties of H_2 adsorbed on Mg (Cashman and Huxford, A., 1936, 3) is given. O. D. S.

Conductivity of insulators and its interpretation. A. Hippel (J. Chem. Physics, 1940, **8**, 605—610; cf. A., 1939, I, 127).—The theory of the elementary processes involved in cryst. conductance is discussed with special reference to NaCl. Various models are considered and an attempt is made to characterise the "*F*" absorption band of the alkali halides. W. R. A.

Zwitterion structures in organic molecules. (Miss) A. Weizmann (Trans. Faraday Soc., 1940, **36**, 978—982; cf. A., 1940, I, 148).—The following dipole moments are recorded: thioxanthone 5·4 D., xanthione 5·4 D., thioxanthione 5·2 D., *N*-methylacridone 3·5 D., *N*-methylthioacridone 5·2 D.,
4 : 4′-$NMe_2\cdot C_6H_4\cdot CH\colon CH\cdot C_6H_4\cdot NO_2$ 8·3 D.,
4 : 4′-$NMe_2\cdot C_6H_4\cdot N\colon N\cdot C_6H_4\cdot NO_2$ 8·1 D.,
4 : 4′-$OMe\cdot C_6H_4\cdot CH\colon CH\cdot C_6H_4\cdot NO_2$ 7·8 D.,
4 : 4′-$OMe\cdot C_6H_4\cdot N\colon N\cdot C_6H_4\cdot NO_2$ 6·5 D. These vals. are all > would be expected, and indicate resonance between the respective classical and zwitterion structures. In the heterocyclic compounds substitution of S for O increases the tendency to zwitterion formation. F. L. U.

Dipole moments of amine oxides. E. P. Linton (J. Amer. Chem. Soc., 1940, **62**, 1945—1948).—The following vals. of the dipole moments in C_6H_6 and dioxan, respectively, are given for oxides of: NMe_3 5·02, 5·04; $NPhMe_2$ 4·79, 4·85; C_5H_5N 4·24, 4·32 D. The large vals. indicate the presence of a $^+N–O^-$ semipolar bond to which a bond moment of 4·38 is attributed. Pyridine oxide resonates among several structures. W. R. A.

Polarisabilities of bonds. I. K. G. Denbigh (Trans. Faraday Soc., 1940, **36**, 936—948).—The mol. refraction of a large no. of org. compounds is shown to be equal to the sum of the individual bond refractions, independently of the atoms present. Vals. for commonly occurring bonds are tabulated. Compounds with conjugated double bonds give abnormally high vals., the order of the single linking between double bonds being ~1·3. The mean polarisability of a bond can be resolved in directions along and at right angles to the bond; the longitudinal polarisability (b_l) is closely related to the length (r) and order (n) of the bond. In diat. hydrides b_l is $\propto r^3$, whilst in bonds not involving H $b_l \times 10^{25} = \sim n^2r^6 + 6{\cdot}0$ (r in A.). F. L. U.

Structure and properties of glasses containing boron. M. L. Huggins (J. Amer. Chem. Soc., 1940, **62**, 2248).—The vol., n, and dispersion of those amounts of a SiO_2 glass which contain 1 g.-atom of O are additive functions of the ratio of the no. of atoms of "metallic" elements to the no. of atoms of O. Equations are given, but these do not hold for glasses containing B. W. R. A.

Magneto-optic rotation: carbon disulphide and benzene solutions. C. E. Waring, H. Hyman, and S. Steingiser (J. Amer. Chem. Soc., 1940, **62**, 2028—2031).—A magneto-optic rotation method is described and used for determining the Verdet consts. of various solutions of C_6H_6, AcOH, $Pr^\beta CO_2H$, $Bu^\beta CO_2H$, and $Bu^\beta OH$ in CS_2. The possibility of determining intermol. structure from the Verdet const. is discussed. W. R. A.

Determination of the proton-attracting properties of liquids. L. P. Hammett (J. Chem. Physics, 1940, **8**, 644).—The vals. for the ionisation const. of weak bases, deduced by Gordy and Stanford (A., 1940, I, 193) from the shift in the OD vibrational frequency of MeOD due to H bonding, are in good agreement with those obtained by Hammett *et al.* (A., 1936, 9) by entirely different methods. W. R. A.

Calculation of the C:C linking strength and of certain resonance energies. D. Wrinch (Science, 1940, **92**, 79).—The C:C linking strengths in C_2H_4 and allene are <94·29 and 92·57 kg.-cal. per g.-mol., respectively. This modification in the C:C linking strength implies increased resonance energies for C_6H_6, $C_{10}H_8$, etc.; these are calc. L. S. T.

Properties of monoethanolamine and its aqueous solutions. R. E. Reitmeier, V. Sivertz, and H. V. Tartar (J. Amer. Chem. Soc., 1940, **62**, 1943—1944).—The following data for $NH_2\cdot[CH_2]_2\cdot OH$ are recorded: m.p. 10·5°; b.p. 171·1±0·1°; ρ and γ (from 25° to 80°); n_D^{20} 1·4539; parachor. γ for aq. solutions (0·001—0·10000 M.) are given. W. R. A.

Quantum theory of *X*-ray reflexion and scattering. I. Geometric relations. (Sir) C. V. Raman and N. S. N. Nath (Proc. Indian Acad. Sci., 1940, **12**, **A**, 83—92).—From equations for the conservation of mass and momentum, the geometrical relations of lattice vibrations produced when *X*-rays fall on a crystal are deduced for the two cases in which the vibrations are (i) in the acoustic, (ii) in the optical, range of frequency. W. R. A.

***X*-Ray examination of poly*iso*butylene.** C. S. Fuller, C. J. Frosch, and N. R. Pape (J. Amer. Chem. Soc., 1940, **62**, 1905—1913).—Fibre patterns

of poly*iso*butylene (I) give a fibre period of 18·63±0·05 A., in agreement with the val. of Brill and Halle (B., 1938, 413). 8 *iso*butylene units are contained in the repeating distance along the chain, supporting other evidence for a 1 : 3 arrangement of the Me group pairs and a helical configuration. Crystals of (I) appear to have an orthorhombic cell with *a* 6·94, *b* 11·96, and *c* 18·63±0·05 A. (fibre axis). The effect of stretching on the *X*-ray pattern of high-mol. (I) is similar to that for natural rubber. W. R. A.

Structure of crystalline aliphatic compounds. *X*-Ray study of dicetyl ether. R. Kohlhaas (Ber., 1940, **73**, [*B*], 189—200).—Dicetyl ether (I) of high purity, m.p. 55°, crystallises in rhombic plates, generally ≮0·01 mm. thick, with angles of 73·56° and 106·44±0·15°. Rotating-crystal photographs give a unit cell (4 mols.; *d* 0·978±0·009) with *a* 5·571, *b* 7·452 A. (±0·2%), *c* sin β 78·19 A. (±0·4%), β 63·07° (±0·5%); space-group, $P2_1/a$ (C_{2h}^5). A close similarity to cetyl palmitate (cf. A., 1938, I, 390), for which the same space-group is now preferred, is indicated, and confirmed by Schiebold–Sauter photographs. The puckered chains of the (I) mol. are collinear, and lie in a plane inclined at 20·92° to the *b*-axis. The chains are 0·874 A. in breadth, and lie ≮4·03 A. apart; the ends of successive chains are 3·22 A. apart. The distance between the C atoms is 1·539 A., and the valency angle 110·82°. These results are in good agreement with data for *n*-paraffins, showing that O and CH_2 are approx. equiv. structurally. Müller's rule (A., 1929, 869) is not verified in this and in other similar cases. A. J. E. W.

Lattice summations for hexagonal close-packed crystals. B. G. Kane and M. Goeppert-Mayer (J. Chem. Physics, 1940, **8**, 642).—Summations have been made over *x–y* planes of a hexagonal close-packed crystal with ideal axial ratio (1·633) for the inverse 6th, 8th, 10th, and 12th power of the distance between the particles. The lattice sums have approx. the same val. as for the face-centred cubic crystal. A direct comparison of the two types of crystal has been made. W. R. A.

Crystal structure of rhombohedral acetamide. F. Senti and D. Harker (J. Amer. Chem. Soc., 1940, **62**, 2008—2019).—NH_2Ac has space group C_{3v}^6—$R3c$, a_0 11·44±0·03, c_0 13·49±0·03 A. referred to the smallest hexagonal unit cell of 18 mols. of NH_2Ac. The complete structure has been determined and it is concluded that (i) the length of the N–H–O bridge is 2·86±0·05 A., (ii) the mol. is planar, (iii) the mol. exists in the keto-form, and (iv) the N–H bonds lie in the plane of the mol. Lengths of bonds and vals. of bond angles are given. W. R. A.

Hydrogen bridge models for globular proteins. M. L. Huggins (J. Chem. Physics, 1940, **8**, 598—600).—Two hypothetical types of structure, obtained by folding from basic patterns containing extended zig-zag polypeptide chains joined together by H bonds, are described. The idealised, undistorted 288-residue open-ended octahedral model has suitable horizontal dimensions for air-dried insulin but its vertical dimensions are rather too large. Structures of this general nature are claimed to have many advantages over the cyclol models of Wrinch. W. R. A.

Hydrogen bond in protein structure. W. T. Astbury (Trans. Faraday Soc., 1940, **36**, 871—880).—The nature of the inter- and intra-mol. linkings in proteins is discussed. Available evidence is insufficient to decide for or against the presence of H bridges. F. L. U.

Formation of intermolecular hydrogen bonds. *X*-Ray evidence. J. M. Robertson (Trans. Faraday Soc., 1940, **36**, 913—921).—Factors favouring the formation of H bonds are discussed and illustrated by reference to the cryst. structure of ice, phenols, carboxylic acids, $H_2C_2O_4,2H_2O$, and diketopiperazine as determined by *X*-ray methods. F. L. U.

Diffraction of *X*-rays by liquid argon. A. Eisenstein and N. S. Gingrich (Physical Rev., 1940, [ii], **58**, 307—309).—Microphotometer records of the *X*-ray diffraction pattern of liquid A obtained with crystal-reflected Mo $K\alpha$ radiation show peaks at sin θ/λ = 0·154 (very strong), 0·280 (medium), and 0·415 (weak). A Fourier analysis of the diffraction pattern gives an at. distribution curve showing approx. 7 atoms at 3·90 A. and 5 atoms at ~5·05 A. A third broad peak occurs at over 7 A. Results indicate that the distribution of atoms in liquid A does not follow closely that in cryst. A, since in the crystal there are 12 nearest neighbours. N. M. B.

Stable relative orientation of groups connected by a carbon–carbon single linking. V. Schomaker and D. P. Stevenson (J. Chem. Physics, 1940, **8**, 637—638).—Polemical against Langseth *et al.* (A., 1940, I, 282) particularly with regard to the structures proposed by these authors for liquid *cyclo*hexane, $(CHCl_2)_2$, and ethylene deuterobromide. W. R. A.

Molecular structures of dimethylchloroamine and methyldichloroamine. D. P. Stevenson and V. Schomaker (J. Amer. Chem. Soc., 1940, **62**, 1913—1916).—Electron diffraction data on NMe_2Cl and $NMeCl_2$ indicate that the N—Cl distances are 0·08 and 0·05 A. >1·69 A., the sum of the covalent radii. This supports previous evidence on the bond lengths between highly electro-negative atoms. Vals. of bond distances and bond angles are given. W. R. A.

Radial distribution method in electron diffraction. J. Walter and J. Y. Beach (J. Chem. Physics, 1940, **8**, 601—604).—Theoretical. A new radial distribution function method for interpreting electron diffraction photographs of gas mols. is discussed and tested for a diat. mol., a linear and a non-linear triat. mol., and CCl_4. W. R. A.

Secondary electron emission. (A) Temperature effects. D. E. Wooldridge. **(B) Order and disorder effects.** D. E. Wooldridge and C. D. Hartman (Physical Rev., 1940, [ii], **58**, 316—321, 381; cf. A., 1939, I, 590).—(A) Measurements of temp. effects on the emission of secondary electrons from Fe, Ni, Co, and Mo show abrupt changes of 1—2% accompanying the α–γ transition of Fe, ~0·4% for the hexagonal to face-centred cubic transformation of Co, and <0·3% for the magnetic trans-

formation of Ni. The temp. coeff. of secondary emission for Ni, Co, and Mo is $\ll$ the vol. coeff. of expansion of the metal. Results support the view that the secondary electrons are scattered or "absorbed" by an excitation process similar to that by which they are produced.

(B) The curve plotted from an investigation of Cu_3Au over the order–disorder temp. range is inconclusive, and indicates that the secondary emission in the two states differs by $\not>$1 or 2%. N. M. B.

Longitudinal magneto-resistance effect on single crystals of iron. Longitudinal magneto-resistance effect at low temperatures of single crystals of iron. Y. SHIRAKAWA (Sci. Rep. Tôhoku, 1940, **29**, 132—151, 152—161).—I. The intensity of magnetisation and the change in electrical resistance of single crystals of Fe of known orientation have been measured in longitudinal magnetic fields up to 1400 oersteds. The magneto-resistance effect increases linearly with field until it reaches saturation sharply at a certain field strength. The effect is strongly anisotropic. The saturation vals. for the [100], [110], and [111] axes are $0{\cdot}00_3$, 0·36, and 0·48%, respectively.

II. The magneto-resistance curves of single-crystal Fe at 0°, −95°, −195° in fields up to 1400 oersteds are similar to each other and to those obtained at room temp. $\Delta R/R$ increases with decreasing temp. O. D. S.

Light figures in single crystals of nickel and copper. M. YAMAMOTO (Sci. Rep. Tôhoku, 1940, **29**, 113—131).—Single crystals of Cu and Ni have been prepared by slow solidification. Light figures produced by reflexion of a narrow pencil of light from surfaces etched with various acid and salt solutions have been investigated and correlated with the crystal structure of the surfaces. O. D. S.

Elasticity of crystals. F. BIRCH and D. BANCROFT (J. Chem. Physics, 1940, **8**, 641—642).—The rigidity of polycryst. Al (m.p. 663°) between 0° and 650° has been measured by a dynamical method. The ratios of resonant frequencies at even temp. to the frequency at 0° and the corresponding ratios of rigidity are tabulated. No conclusive evidence has been obtained on whether rigidity vanishes at the m.p. or retains a finite small val. W. R. A.

Internal friction of single metal crystals. T. A. READ (Physical Rev., 1940, [ii], **58**, 371—380).—The internal friction of cryst. Cu, Sn, Pb, and Zn has been measured by the composite piezoelectric oscillator method. It is found that the decrement of an unannealed crystal may be as large as that of the polycryst. material, but is reduced by annealing to a val. of $\sim 10^{-4}$—10^{-5}, and that both Young's modulus and the decrement vary with the vibrational strain amplitude at strain amplitudes as low as 10^{-6}. For Zn crystals the dependence of the elastic modulus and internal friction on previous history of the specimen, vibration frequency and amplitude, and on the orientation of the vibration axis to the crystal slip planes has been investigated; the results suggest that the mechanism involved is a propagated "dislocation" of the sort proposed to account for macroscopic plastic flow. N. M. B.

Titanium. XV. Polymorphous structures of titanium dioxide. A. V. PAMFILOV and E. G. IVANTSCHEVA (J. Gen. Chem. Russ., 1940, **10**, 154—157).—The existence of TiO_2 having a brookite structure is not confirmed. R. T.

Dielectric strength of liquid and solid benzene. W. BÄHRE (Arch. Elektrotech., 1937, **31**, 141—165; Chem. Zentr., 1937, i, 4627—4628).—The effect of wave-form, impurities (particularly H_2O and air), and temp. on the dielectric strength (X) of liquid C_6H_6 is examined. The max. observed val. of X is 1870 kv. per cm.; with undried C_6H_6, not de-aërated, X = 1330 kv. per cm. (±10%) at atm. pressure and room temp., with a 0·7-mm. gap. The results are in general agreement with Koppelmann's theory (A., 1936, 665). For solid C_6H_6 X is only ~150 kv. per cm., and depends largely on crystal size. A. J. E. W.

Elasto-resistance change of nickel, iron, and some nickel–iron alloys. N. YAMANAKA (Sci. Rep. Tôhoku, 1940, **29**, 36—68).—The change in electrical resistance of Ni, Fe, and nine Ni–Fe alloys (from 15 to 90% Ni) produced by tension up to the elastic limit in the presence of magnetic field up to 439 oersteds has been measured. The resistance change of magnetic origin increases or decreases with tension according as the magnetic elongation is positive or negative. For small tensions the resistance change is in accordance with the domain theory of ferromagnetism. O. D. S.

Superconductors. (A) Phenomenological theory. (B) Complete data and boundary conditions. E. COOK (Physical Rev., 1940, [ii], **58**, 357—361, 361—364).—Mathematical. (A) A rigorous theory leading to results identical with those of London is developed.

(B) A set of data and boundary conditions, mathematically complete and physically significant, for the London theory is derived. N. M. B.

Diamagnetism and the hydrogen bond. W. R. ANGUS and W. K. HILL (Trans. Faraday Soc., 1940, **36**, 923—927).—The diamagnetic susceptibility of BzOH, *o*-, *m*-, and *p*-$OH{\cdot}C_6H_4{\cdot}CO_2H$, and *p*-$OH{\cdot}C_6H_4{\cdot}NO_2$ dissolved in liquids of different proton-attracting powers was measured. Preliminary results indicate that the χ for H-bonded structures involving ring formation is < that calc. by an additive law, and diminishes with increasing solute concn. The reverse is true when the H-bonding occurs between solute and solvent. F. L. U.

Specific heats of copper nitride, niobium nitride, and sodium azide, and the atomic heat of nitrogen. S. SATOH and T. SOGABE (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 943—950).—From measurements of the sp. heat of Cu_3N (0—99·6°), NbN (0—99·6° and 0—300°), and NaN_3 (0—99·6°) vals. of the at. heat of N have been deduced as 3·94, 4·44, and 4·10, respectively, in good agreement with previous vals. (*e.g.*, A., 1940, I, 201). W. R. A.

Gaseous heat capacities. II, III. G. B. KISTIAKOWSKY and W. W. RICE (J. Chem. Physics, 1940, **8**, 616—618, 618—622; cf. A., 1939, I, 362).—II. An extension of previous work to allene, CH⁚CMe, *cyclo*propane, propylene, and C_3H_8.

III. The heat capacities of Me_2O, $(CH_2)_2O$, $(CMe:)_2$, *cis*- and *trans*-Δ^β-butene are discussed. W. R. A.

Heat capacity and entropy, heats of fusion and vaporisation, and the vapour pressure of *n*-butane. J. G. ASTON and G. H. MESSERLY (J. Amer. Chem. Soc., 1940, **62**, 1917—1923).—C_p vals. for n-C_4H_{10} have been determined from 12·73° to 272·66° K. The v.p. is given by $\log_{10} p$ (mm.) $= -2352{\cdot}900/T + 16{\cdot}49230 \log_{10} T + 0{\cdot}011111869T + 48{\cdot}64763$. The following consts. have been determined: transition temp., —165·60°; m.p. —138·29°; b.p. —0·50° (272·66±0·03° K.); heat of transition 494·0±1, of fusion 1113·7±1, and of vaporisation 5351±15 g.-cal. per mol.; $S_{272\cdot66°\text{ K.}}$ (ideal gas at 1 atm.) = 72·05±0·2; $S_{298\cdot16°\text{ K.}}$ (ideal gas at 1 atm.) = 74·0; $S_{298\cdot16°\text{ K.}}$ (liquid) = 55·2 g.-cal. per degree per mol. Using a val. of 3300 g.-cal. per mol. for Me group potential, the experimental val. of S, and the C-chain vibration frequency of Kohlrausch and Koppe (A., 1934, 942), the restricting potential or torsional frequency associated with the restricted rotation of the two Et about the middle C–C linking has been evaluated as ~30,000 g.-cal. per mol. Vals. of thermodynamic functions are derived for temp. between 272·7° and 1300° K. W. R. A.

Heat capacity and entropy, heats of fusion and vaporisation, and the vapour pressure of *iso*-butane. J. G. ASTON, R. M. KENNEDY, and S. C. SCHUMANN (J. Amer. Chem. Soc., 1940, **62**, 2059—2063).—C_p vals. for *iso*-C_4H_{10} have been determined from 12·53° to 261·44° K. The v.p. is given by $\log_{10} p$ (mm.) $= -1716 - 687/T - 6{\cdot}38879 \log_{10} T + 0{\cdot}0024132T + 24{\cdot}260325$. The following consts. have been determined: m.p. —159·42° (113·74±0·5° K.); b.p. —11·72° (261·44±0·02° K.); heat of fusion 1085·4±0·5 and of vaporisation 5089·6±8 g.-cal. per mol. From thermal data, $S_{298\cdot16°\text{ K.}}$ (ideal gas at 1 atm.) = 70·43±0·15, $S_{298\cdot16°\text{ K.}}$ (saturated liquid) = 52·09±0·10 g.-cal. per degree per mol. These vals. are > that deduced from spectroscopic and mol. data by, at the b.p., 5·08 entropy units, which is assumed to represent the potential restricting internal rotation of the Me groups (3870 g.-cal.). W. R. A.

Thermodynamic properties of methyl cyanide and methyl *iso*cyanide. R. H. EWELL and J. F. BOURLAND (J. Chem. Physics, 1940, 8, 635—636).—By combining the electron diffraction data of Brockway (A., 1937, I, 119) and the mol. spectroscopic data of Badger and Bauer (A., 1937, I, 165) vals. of $-(G^\circ - U^\circ_0)/T$, $(H^\circ - U^\circ_0)/T$, S°, and C°_p for the ideal gas state of MeCN and MeNC have been calc. from 273° to 773° K. W. R. A.

Thermodynamics of irreversible processes. I. Simple fluid. C. ECKART (Physical Rev., 1940, [ii], **58**, 267—269; cf. *infra*).—Mathematical. The rate of increase of entropy of a simple heat-conducting viscous fluid is investigated in detail. It is shown that if Kelvin's hypothesis on abs. temp. is adopted and the usual law of viscosity assumed the requirements of the second law are satisfied. N. M. B.

***X*-Ray investigation of the phase transitions of sodium palmitate.** F. G. CHESLEY (J. Chem. Physics, 1940, 8, 643).—Investigation of phase transitions of Na palmitate by a temp.-controlled X-ray powder method has revealed the existence of seven phases and six transitions between room temp. and 290° (isotropic liquid). The transition temp. are in good agreement with those found dilatometrically by Vold and Vold (cf. B., 1939, 743) and, in addition, a new transition temp. at 67° is recorded. W. R. A.

Transformations of carbamide of a higher order. V. A. SOKOLOV (J. Gen. Chem. Russ., 1940, **10**, 165—171).—The coeff. of expansion of $CO(NH_2)_2$ is anomalously high at —2° and at 33°, indicating transformations of a higher order at these temp. R. T.

Joule–Thomson effect in mixtures of helium and argon. J. R. ROEBUCK and H. OSTERBERG (J. Chem. Physics, 1940, 8, 627—635).—The Joule–Thomson effect has been measured in four mixtures of He and A and, from isenthalpic curves, the Joule–Thomson coeff. has been calc. for various temp., pressures, and composition. W. R. A.

Thermodynamics of irreversible processes. II. Fluid mixtures. C. ECKART (Physical Rev., 1940, [ii], **58**, 269—275; cf. *supra*).—Mathematical. The possibility of constructing a systematic theory of irreversible processes is surveyed in general terms and for a mixture of ideal gases. N. M. B.

Partial pressure of hydrogen chloride from its solutions in monohalogenobenzenes at 25°. S. J. O'BRIEN and J. B. BYRNE (J. Amer. Chem. Soc., 1940, **62**, 2063—2065).—Measurements of the partial v.p. of HCl from its solutions in PhF, PhCl, PhBr, and PhI over the concn. ranges 0·02—0·12, 0·008—0·103, 0·013—0·069, and 0·006—0·04M., respectively, show that Henry's law is obeyed but that there is positive deviation from Raoult's law. W. R. A.

Vapour pressure of glycerin solutions at 20°. D. W. GROVER and J. M. NICOL (J.S.C.I., 1940, **59**, 175—177).—The v.p. of glycerin (I) solutions from 25% to 92% by wt. are measured by determining the dew point of air maintained in equilibrium with the solutions. By means of Dühring's rule it is proved that the relative v.p. of (I) solutions is substantially independent of temp. over the range 0—70°, a fact which enables the figures of various workers to be compared. The relative v.p. obtained at 20° are in good agreement with the majority of the published data, but not with one table in the International Critical Tables, which must therefore be considered to be in error.

Vapour pressure of glycerin. (A) E. C. CRAVEN. (B) D. W. GROVER (Chem. and Ind., 1940, 690).—(A) The assumption made by Grover and Nicol (preceding abstract), that the dew point method gives only the partial pressure of H_2O, is criticised.

(B) Reasons are given for the belief that in practice the dew deposit from glycerin solutions consists of H_2O only, at least for concns. $\ngtr$90%. F. L. U.

Trimethylcarbinol as a cryoscopic solvent. F. H. GETMAN (J. Amer. Chem. Soc., 1940, **62**, 2179—2180).—The cryoscopic const. of $Bu^\gamma OH$ has been determined from f.p. measurements on 30 sub-

stances and is 8·37. Unless precautions are taken in the prep. and preservation of Bu$^{\gamma}$OH results are vitiated by association effects. W. R. A.

Theory of diffusion, viscosity, and electrolytic conduction. S. KANEKO (Bull. Chem. Soc. Japan, 1940, **15**, 276—280).—By combining Horiuti's theory of reaction velocity with Einstein's theory of diffusion, certain relationships between χ, η, and K (diffusion coeff.) are obtained. F. J. G.

Carbamide. I. Hygroscopicity of soluble substances. Vapour pressures of saturated salt solutions. W. SAKAI (J. Soc. Chem. Ind. Japan, 1940, **43**, 104—106B).—Solids become hygroscopic when the humidity is > that over their saturated solution at the given abs. temp. T. The v.p. of saturated solutions is expressed by $\log p = -D/T + E \log T + FT + i$, where D, E, F, and i are consts. The crit. humidity π above which solids become hygroscopic is $\pi = 100p/p_0$, where p_0 is the v.p. of the pure solvent at temp. T. Calc. vals. of π agree with experimental for NaCl, K_2SO_4, and KNO_3, at 291—295° K. R. T.

Silicate glasses. M. L. HUGGINS (J. Chem. Physics, 1940, **8**, 641).—Vols. (V_o), n, and dispersions of well-annealed silicate glasses are simple additive functions of the compositions, when calc. for the quantity of glass containing one g.-atom of O and when the compositions are expressed as the no. of atoms (N_m) of the "metallic" elements per O. The plot of V_{oSi} against N_{Si} for Na_2O–SiO_2 glasses is given and the different slopes are discussed. W. R. A.

Susceptibility of mixed crystals to chemical attack. R. SCHENCK (Festschr. Tech. Hochschule Breslau, 1910—1935, 432—435; Chem. Zentr., 1937, i, 4191).—By utilising the fact that CuO or Cu_2O evolves O_2 when heated with Au, Pt, or Pd (M), with formation of Cu–M mixed crystals, the equilibrium relationships in the system Au–Cu–O are examined. The distribution coeffs. of Cu between Au, Pt, and Pd are deduced from the [Cu] in the Cu–M alloys. The forces which tend to alloy the Cu with M are sufficiently strong to exceed the chemical affinity of Cu and O. The reactivity of the Cu towards external influences is reduced by lattice forces, and may be completely suppressed even by free diffusion into the M lattice. A. J. E. W.

Factors affecting the formation of 3/2 electron compounds in alloys of copper, silver, and gold. W. HUME-ROTHERY, P. W. REYNOLDS, and G. V. RAYNOR (J. Inst. Metals, 1940, **66**, 191—207).—In many alloys of Cu, Ag, and Au with elements of the B-sub-groups of the periodic system the phase next to the α solid solution has a composition near to that required by an electron concn. of $\sim$1·5, *i.e.*, is a 3/2 electron compound. The structures of these phases are (*a*) body-centred cubic disordered β or ordered β', (*b*) close-packed hexagonal ζ or ζ', or (*c*) of the β-Mn type (μ). The phases are formed only when the difference between the at. diameters of solvent and solute, *i.e.*, the "size factor," is favourable. From a detailed examination of the various equilibrium diagrams it appears that increasing valency favours the ζ or μ structure at the expense of the β or β' structures, increasing temp. and size factor favour the β structure, and increasing size factor moves the composition in the direction of lower electron concn. and narrows the range of composition of the phases in terms of electron concn. Au alloys have the greatest and Cu the smallest tendency to form ordered β' structures. As the solvent and solute metals differ to an increasing extent in their electrochemical properties another factor (electrochemical factor) comes into play; in alloys with the more electropositive metals Cu, Ag, and Au are the electronegative members of the alloys and the electrochemical factors are in the order Au > Ag > Au, whereas in alloys with the electronegative elements these factors are in the reverse order and the Cu, Ag, and Au are the electropositive members of the alloys. With increasing electrochemical factor the tendency to form β' structures with long-range order increases, and may be such that the β' solidus and liquidus curves rise to a max., *e.g.*, in Au–Mg alloys. The shape of the Cu–Be equilibrium diagram is explained on the basis of the effect of the development of long-range order. Frequently when the % of solute is high the diagrams begin to acquire the characteristics expected in ordered structures although X-rays show that long-range order does not exist; it is suggested that a short-range order may be present and it is shown that this would account for the shapes of parts of the diagrams and for the limiting compositions to which some of the phase boundaries approach. A. R. P.

Constitution and structure of alloys of intermediate composition in the systems copper–indium, copper–aluminium, copper–germanium, silver–aluminium, and silver–germanium. W. HUME-ROTHERY, G. V. RAYNOR, P. W. REYNOLDS, and H. K. PACKER (J. Inst. Metals, 1940, **66**, 209—239; cf. preceding abstract).—In the Cu–In system the α + liquid $\rightleftharpoons \beta$ peritectic temp. is 710°, the liquid $\rightleftharpoons \beta + \gamma$ eutectic temp. 676°, and the $\beta \rightleftharpoons \alpha + \delta$ eutectoid temp. 574°; Cu dissolves 10·9 at.-% of In at 574° and the eutectoid composition is In 20·15 at.-%. In the Cu–Al system the $\beta \rightleftharpoons \alpha + \delta$ eutectoid is at Al 24 at.-%, 560—565°; under equilibrium conditions there is no evidence of the existence of any modification of the β phase, those modifications previously reported being metastable intermediate forms. In the Cu–Ge system the peritectic horizontal, α + liquid $\rightleftharpoons \zeta$, is at 822·5° and starts at Ge $\sim$12 at.-%; the lower peritectic horizontal, ζ + liquid $\rightleftharpoons \gamma$, is at 743° and starts at Ge 18·3 at.-%, whilst the $\zeta + \gamma/\zeta + \varepsilon$ horizontal is at 540° and starts at Ge 18·2 at.-%. In the Ag–Al system the $\alpha + \beta \rightleftharpoons \zeta$ transformation occurs at 610°, the $\beta \rightleftharpoons \beta + \zeta$ transformation at a min. of 604·5° with Al 24·5 at.-%, and the $\alpha + \zeta \rightleftharpoons \mu$ transformation at 448°, Al 20·65—23·8 at.-%. The range of composition of μ broadens considerably with fall in temp. and the areas of the $\alpha + \mu$ and $\mu + \zeta$ phase fields also extend rapidly. No evidence was found of the existence of a 3/2 electron compound in the Ag–Ge system; the eutectic temp. in this system is placed at 651°. A. R. P.

Temperature-dependence of Young's modulus of β-brass single crystals. J. S. RINEHART

(Physical Rev., 1940, [ii], **58**, 365—371; cf. Siegel, A., 1940, I, 250).—Young's modulus, E, of 7 single crystals of β-brass was measured by the composite piezo-electric oscillator method as a function of temp. for 25—505° in order to study order–disorder phenomena. $1/E$ is linearly related to the orientation function at all temp. The max. and min. vals of $1/E_{[100]}$ and $1/E_{[111]}$ are 3·881 and 0·475 × 10^{-12} at room temp. and 4·970 and 0·583 × 10^{-12} sq. cm. per dyne at the crit. temp. 468°. The elastic anisotropy $E_{[111]}/E_{[100]}$ is 8·2 at room temp., decreasing to a min. 7·2 at 300°, and increasing to 8·6 at the crit. temp. Plots of $1/E$ for the directions [100], [110], and [111] show that the effect of disorder is felt mainly in the first two directions, whilst in the third the elasticity shows an approx. linear increase with rising temp. Before disorder sets in, the elasticity in the [100] direction decreases with rising temp., contrary to the usual behaviour of elastic materials. N. M. B.

Measurement of gyromagnetic effect of manganese–antimony and iron–selenium alloys. F. Galavics (Helv. Phys. Acta, 1939, **12**, 581—608).—The gyromagnetic effect of Mn–Sb (Mn 48·6%, Sb 50·0%, Fe 1·4%) and Fe–Se alloys in powder form has been investigated by the resonance method of Coeterier (*ibid.*, 1932, **3**, 217). For the Mn–Sb alloy the Landé splitting factor $g = 2$ within experimental error. Vals. of g for the Fe–Se alloy are uncertain owing to the high permanent moment of the substance and vary between 0·35 and 0·88. O. D. S.

Order–disorder transformations in ternary alloys. T. Hirone and S. Matuda (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 931—942).—The Williams statistical theory of order–disorder transformations in binary alloys is extended to ternary alloys, and vals. of sp. heat, entropy, and free energy of an alloy of the Cu_2MnAl type have been calc. W. R. A.

Critical solution temperatures and aniline points of some butane hydrocarbons. C. G. Ludeman (Ind. Eng. Chem. [Anal.], 1940, **12**, 446—448).—Apparatus is described and procedure detailed for determining the miscibility temp. for mixtures of volatile hydrocarbons with NH_2Ph. The NH_2Ph points of *n*- and *iso*-C_4H_{10} and *iso*-C_4H_8 are 83·1°, 107·6°, and 14·9°, respectively, and the crit. solution temp. 84·1°, 109·0°, and 15·8°. J. D. R.

Effect of certain factors on the relation between chemical composition and solubility (m.p.). V. P. Schischokin (Ann. Sect. Anal. Phys.-Chim., 1940, **12**, 213—227).—A review. R. T.

Aqueous solubilities of aliphatic ketones. P. M. Ginnings, D. Plonk, and E. Carter (J. Amer. Chem. Soc., 1940, **62**, 1923—1924).—The aq. solubilities of 12 aliphatic ketones have been measured at 20°, 25°, and 30°. The smaller is mol. size, the greater is solubility. Among isomerides, the most compact is the most sol. and movement of the CO group towards the centre of the chain reduces the solubility. W. R. A.

Lecture demonstration of mixed solvent action. H. K. Sen and S. R. Palit (Current Sci., 1940, **9**, 333—334).—Experiments are described. J. L. D.

Heats of adsorption of gases on iron synthetic ammonia catalysts at low temperatures. R. A. Beebe and N. P. Stevens (J. Amer. Chem. Soc., 1940, **62**, 2134—2140).—The differential heats of adsorption of several gases have been measured between 0° and —183° using a doubly-promoted Fe (1·59% K_2O, 1·3% Al_2O_3) and a pure Fe catalyst. Chemisorbed gas has been determined and attempts have been made to differentiate between van der Waals adsorption and chemisorption. Measurements indicate that adsorption of N_2 and A at —183° is entirely van der Waals; H_2 at —183°, and CO at —183°, —78°, and 0° partly chemisorption; CO_2 at —78° is chemisorbed on the promoted but van der Waals on the pure Fe catalyst. O_2 measurements at —183° indicate complex adsorption with possible formation of Fe oxide. W. R. A.

Sorption of gases and vapours by titania gel. VII. Sorption and desorption equilibria of organic vapours and a critical condition for capillary condensation phenomena. I. Higuti (Bull. Inst. Phys. Chem. Res. Japan, 1940, **17**, 951—975; cf. A., 1939, I, 561).—Sorption and desorption isotherms at 0°, 10°, 20°, and 30° have been obtained for vapours of MeOH, EtOH, Pr^aOH, $Pr^\beta OH$, PhCl, PhMe, *n*-C_6H_{14}, *n*-C_7H_{16}, $COMe_2$, and EtOAc by TiO_2 gel. The isotherms consist of two parts; in the lower relative pressure range the curve represents adsorption of vapour on the gel surface, whilst at higher relative pressures capillary condensation of adsorbates in the pores of the gel occurs. W. R. A.

Sorptive and catalytic properties of active manganese dioxide, with reference to vapours and gases. III. Formation at active manganese dioxide of oxides of nitrogen. E. V. Alexeevski and V. B. Aleskovski (J. Gen. Chem. Russ., 1940, **10**, 137—145; cf. A., 1938, I, 88).—Evolution of oxides of N observed when air, O_2, or other gas is passed over active MnO_2 is ascribed to desorption of N_2O_3, adsorbed from the air during prep. of the MnO_2. Adsorbed oxides of N may be completely eliminated by heating the MnO_2 at 300°. R. T.

Application of Polanyi theory to bound water. I. Calculation of adsorption potential from vapour pressure of bound water. R. E. Neumann and O. V. Neumann. **II. Effect of nature of dissolved substances on water bound from solutions.** O. V. Neumann and R. E. Neumann (Kolloid. Shurn., 1938, **4**, 3—11, 13—18).—I. The apparent adsorption of H_2O from 0·02—0·3M. solutions of EtOH by cotton wadding has been measured at 0—53°, and the results are examined in terms of the atm. theory of adsorption. The amount (x) of H_2O bound from a solution of given concn. falls linearly with rise of temp., except for the more conc. solutions. The vals. of the adsorption potential, ϵ, calc. from the v.p. of the solution, plotted against x all fall on the same curve, irrespective of the temp.

II. At low concns. the amounts of H_2O fixed from solutions of $Bu^\beta OH$, glucose, and sucrose of the same concn. are not equal, but with increasing concn. they approach and ultimately coincide. It is deduced that

at the higher concns. the more loosely held H_2O (I) has been removed by osmotic forces, and only oriented H_2O mols. remain; (I) may be supposed to dissolve some solute. The ϵ–x curve is not influenced by the temp., but varies with the solute. R. C.

Adsorption of malachite-green by clays and allied minerals. V. L. BOSAZZA (Nature, 1940, **146**, 334).—Kaolinite (I), anauxite, montmorillonite, pyrophyllite, talc, and beidellite are stained different shades of green or blue by the dye. The amounts of dye absorbed and the degrees of fastness differ with the different minerals. Washing with H_2O, acid, or alkali fails to remove the adsorbed dye from (I). L. S. T.

Adsorption of fluorides by enamel, dentine, bone, and hydroxyapatite.—See A., 1940, III, 755.

Ageing and coprecipitation. XXXII. Adsorptive properties and the determination of the specific surface of lead chromate. I. M. KOLTHOFF and F. T. EGGERTSEN (J. Amer. Chem. Soc., 1940, **62**, 2125—2131; cf. A., 1940, I, 108).—The determination of the sp. surface of fresh and aged ppts. of $PbCrO_4$ by means of wool-violet (I) and Th-*B* is described. With (I) equiv. amounts of dye and Pb are removed from the solution, and on the saturated surface one (I) ion is adsorbed per 2 mols. of $PbCrO_4$. $Pb(OAc)_2$ is adsorbed unimolecularly from a dil. solution in 95% EtOH on the surface of $PbCrO_4$. Radioactive methods give new procedures for the determination of surface area. W. R. A.

(A) **Application of surface tension to physico-chemical analysis of rational systems.** N. A. TRIFONOV and G. K. ALEXANDROV. (B) **Surface tension isotherm of binary liquid systems.** N. A. TRIFONOV. (C) **Surface tension of the rational systems aniline–allylthiocarbimide and acetic anhydride–water, in connexion with their other properties.** N. A. TRIFONOV and A. T. CHALEZOVA. (D) **Surface tension of irrational binary liquid systems.** N. A. TRIFONOV and R. V. MERTZLIN (Ann. Sect. Anal. Phys.-Chim., 1940, **12**, 85—101, 103—121, 123—137, 139—155).—(A) Theoretical. Possible types of surface tension (σ)–composition curves of rational binary systems are discussed.

(B) The literature is reviewed, and the forms of σ–composition diagrams of systems of the type A + B $\rightarrow$ AB, where AB is an undissociated or slightly dissociated compound, are discussed.

(C) The σ–composition curves of the system NH_2Ph–CHMe:CH·NCS at 100° and 125° consist of two ascending branches intersecting at 50 mol.-%, corresponding with NHPh·CS·NH·CH:CHMe. The corresponding diagram for Ac_2O–H_2O (25°, 50°, and 75°) consists of two descending branches, intersecting at a min. at 50 mol.-%, corresponding with formation of AcOH.

(D) Possible forms of σ–composition curves of systems of the type A + B $\rightarrow$ AB, where AB is a highly dissociated compound, are discussed, and are illustrated by the systems EtOAc–$SnCl_4$ (20°, 40°, 60°), PhOH–piperidine (25°, 50°) and –NH_2Ph (25°, 50°, 75°, 100°), C_5H_5N–AcOH (0°, 25°, 50°, 75°), and chloral–H_2O (50°, 75°). R. T.

Measurement of linear tension at the boundary liquid–liquid–air. R. S. BRADLEY (Trans. Faraday Soc., 1940, **36**, 999—1003).—An equation is derived giving a relation between the linear tension f at a liquid–liquid–air boundary and the diameter, thickness at centre, and diameter corresponding with max. thickness, of lenses of one liquid floating on another. The equation is applied to calculate f from measurements of the dimensions of lenses of oleic acid on aq. solutions at various p_H vals., and of lenses formed from conjugate solutions of PhOH and H_2O. Substantially the same vals. of f are obtained by measuring the period of oscillation of a deformed lens. The equation can also be used to calculate the spreading pressure of the lighter liquid, and the interfacial tension of the liquid phases if their surface tensions are known. F. L. U.

Capillary behaviour in porous solids. M. C. LEVERETT (Amer. Inst. Min. Met. Eng., 1940, Tech. Paper 1223, 17 pp.; Petrol. Tech., **3**, No. 3).—The equilibrium distribution of two immiscible fluids of different densities in a porous solid is discussed theoretically on the basis of the formation of inter-fluid interfaces the curvature of which depends on the size of the inter-grain spaces and the proportions of the fluids present. An apparatus for determining the capillary equilibrium of fluids in unconsolidated sand is described. It is shown that the extent of the two-fluid interfacial area can be deduced thermodynamically from the curvature–saturation relation. The theory is applied to the flow of mixtures of two or three immiscible fluids (*e.g.*, air, oil, and H_2O) in porous sand. The existence of a boundary effect at the outflow face of the sand column, retarding the egress of oil and H_2O, is emphasised. J. W. S.

Monolayers of esters and chlorinated derivatives possibly useful as lubricating addition agents. G. L. CLARK and J. V. ROBINSON (J. Amer. Chem. Soc., 1940, **62**, 1948—1951).—The areas per mol. at zero compression and the collapse pressures have been determined for monolayers (on H_2O) of Me stearate (I), α-chloro- and dichloro-stearate, oleate, ricinoleate, and chlororicinoleate, ethylene glycol distearate (II) and ricinoleate, and $(C_6H_4Me)_3PO_4$, and (on Cl_2–H_2O) of Me oleate and ricinoleate. Films were built up by the Blodgett–Langmuir method. (I) and (II) give solid condensed films, whilst the others form liquid films. An improved film balance is described. W. R. A.

Molecular interactions at oil–water interfaces. III. Interfacial tension measurements. A. E. ALEXANDER and J. H. SCHULMAN (Trans. Faraday Soc., 1940, **36**, 960—964; cf. A., 1940, I, 320).—The lowering of γ between aq. Na dodecyl sulphate and C_6H_6 solutions of oil-sol. emulsifiers is in the order cholesterol = octadecyl alcohol = elaidyl alcohol > oleyl alcohol > cholesteryl myristate, agreeing with the order of stability of the corresponding oil-in-H_2O emulsions. Addition of Na_2SO_4 or of $(NaPO_3)_3$ to aq. $C_{17}H_{35}·NH_2,HCl$ in contact with C_6H_6 causes a rapid rise in γ followed by a fall to < the initial val., while the originally liquid interfacial film becomes solid. F. L. U.

Study of amorphous films by electron diffraction. S. YAMAGUCHI (Nature, 1940, **146**, 333). Hygroscopic substances such as $ZnCl_2$ give electron diffraction haloes as well as rings in a high vac. In the $ZnCl_2$–H_2O films that can be produced on a cleaned Pt wire, the rings are due to crystals of $ZnCl_2$, and the haloes to a saturated solution of $ZnCl_2$. L. S. T.

Gelation phenomena in wheat-flour films. J. D. HAMILTON (Canad. J. Res., 1940, **18**, **B**, 194—202).—The behaviour of wheat-flour protein monolayers on H_2O, produced by spreading from foam, has been investigated, and empirical equations are derived to represent the force–area relationships. The results indicate that the protein forms a gel when the film area is decreased, and that degelation occurs when the area is increased again. It is suggested that, at the point of gelation, the protein micelles form a close-packed film, the residues being outside the surface in such a manner that the binding force between the film micelles and the aq. substrate is normal to the surface. Further compression of the film is supposed to cause the film, together with a layer of substrate, to curl into logarithmic spirals, which constitute the gel structure. J. W. S.

Evaporation of water through multimolecular films. A. R. DOCKING, E. HEYMANN, L. F. KERLEY, and K. N. MORTENSEN (Nature, 1940, **146**, 265).—Evaporation through layers of paraffin oil 0·5—5 μ. thick, obtained by means of spreading agents, has been investigated. Films 1—2 μ. thick which reduce evaporation by 50—60% are easily obtained. The best films are obtained from dil. (1 : 50) solutions of boiled linseed oil, stand oil, terebinth oil, or high-boiling fractions of eucalyptus oil in white paraffin oil. High reductions (~99%) are obtained with thin films (0·5—1·0 μ.) of certain high-boiling fractions of the neutral oil of vertical-retort tar. Reduction of evaporation in a wind is > in still air, if the continuity of the film is not seriously affected by the wind. L. S. T.

Foaming.—See B., 1940, 711, 712.

Stability of emulsions. II. Emulsions stabilised by hydrophilic colloids. A. KING and L. N. MUKHERJEE (J.S.C.I., 1940, **59**, 185—191; cf. A., 1939, I, 468).—Emulsions of olive oil and kerosene stabilised by (1) agar, (2) gelatin, (3) gums acacia and tragacanth, (4) egg yolk, (5) lecithin, (6) Irish moss, and (7) saponin were examined by the size-frequency technique when freshly prepared and after various times. All these emulsions except (5) deteriorated by gradual increase of droplet size without oil separation. The coarser emulsions were very stable. HCl and $CaCl_2$ broke or inverted (4) and (7) and coarsened the other systems. Heating coarsened all systems, the effect corresponding with viscosity change.

Emulsifying power of some natural emulsifiers. N. F. JERMOLENKO and V. J. GUTERMAN (Kolloid. Shurn., 1938, **4**, 85—91).—The emulsifying power of bile, as evaluated by drop-no. measurements, is the greater the greater is the difference in polarity between the two phases to be emulsified, and is considerable even in the system C_6H_6–H_2O. With both bile and egg-yolk the emulsifying power arises from the presence of highly surface-active substances and the power of forming a tough interfacial film. R. C.

Determination of dimensions of colloid particles. S. E. CHARIN (Kolloid. Shurn., 1938, **4**, 77—83).—A simple comparative nephelometric method for determining degree of dispersity is described. For technical sols which are not deeply coloured the spectrophotometer may be used. The size of the colloid particles in starch syrup has been determined by diffusion measurements. R. C.

Systems of four components. II. Stability of ferric hydroxide hydrosols. I. MARKEVITSCH and M. CHOLODOVA (Kolloid. Shurn., 1938, **4**, 63—66).—The presence of various org. acids in the prep. of $Fe(OH)_3$ sols reduces their sensitivity to EtOH. In presence of tartaric acid yellow forms of $Fe(OH)_3$ appear which adsorb $H_2C_2O_4$ more readily than does brown $Fe(OH)_3$, and, unlike the latter, can, after drying, be partly peptised by H_2O. R. C.

Constitution of colloidal silica. P. C. CARMAN (Trans. Faraday Soc., 1940, **35**, 964—973).—Assuming that in SiO_2 the surface Si ions tend to complete the –Si–O– tetrahedra that are the characteristic structural units of both SiO_2 and silicates, it follows that a single layer of H_2O mols. will be bound so strongly at a SiO_2 surface as to give, in effect, surface OH groups with a weak tendency to dissociate and form H ions. Further, since OH does not form part of the internal structure, hydration of SiO_2, unlike that of, *e.g.*, CaO, is confined to the surface; transition from massive SiO_2 to a mol. of $Si(OH)_4$ is therefore continuous and the degree of hydration depends entirely on the degree of subdivision. The coarsening of SiO_2 sols with time, their behaviour towards electrolytes, the formation and irreversible shrinkage of SiO_2 gels, and the constitution of Na silicates are explained on the same basic assumption. F. L. U.

Dielectric study of synthetic highly polymerised compounds in organic liquids. I—III. Dielectric study of benzene solutions of mono- and poly-chloroprene, mono- and poly-vinyl acetate, and mono- and poly-styrene. S. LEE (J. Soc. Chem. Ind. Japan, 1940, **43**, 190—191B).—A summary of work previously noted (A., 1939, I, 469). F. L. U.

Binding of water by stearanilide. B. A. TOMS (Nature, 1940, **146**, 266).—Fractional pptn. by H_2O of a 0·1% solution of stearanilide in EtOH and measurements of η of the filtered solutions give results that support the view (A., 1940, I, 360) that "bound" H_2O in the hydrated anilides of stearic and palmitic acids is held by a micellar structure. L. S. T.

Influence of starch cations on certain properties of the starch. J. DEDEK, B. JELINEK, and I. KULCICKYJ (Ann. Ferm., 1936, **2**, 79—85; Chem. Zentr., 1937, i, 4644).—Changes of η with temp. are identical for starches treated with NaCl and $CaCl_2$, but different for HCl-treated specimens; η rises rapidly and then falls as the temp. increases. The swelling properties differ in each case. A. J. E. W.

Reactions relating to carbohydrates and polysaccharides. LXII. Relation between concentration and viscosity of polyoxyethylene glycols. LXIII. Surface tensions of aqueous solutions of polyoxyethylene glycols. E. L. LOVELL and H. HIBBERT (J. Amer. Chem. Soc., 1940, **62**, 2140—2143, 2144—2148).—LXII. η of 42- and 90-membered oxyethylene glycols and the 42-membered dichloride in dioxan, and of the 186-membered glycol in CCl_4, have been measured at 20° and over the concn. ranges 1—4·5% and 2—10% respectively. For dil. solutions (<5%) a linear relationship exists between η and concn. (c), and the Arrhenius equation, $\log \eta = Kc$ holds at all concns. Vals. of sp. η are additive and the polyoxyethylene chain appears to be highly convoluted in solution.

LXIII. γ of aq. solutions of single polymeric oxyethylene glycols (3, 6, 18, 42, 90, and 186 repeating units respectively; cf. A., 1939, II, 402) have been measured at various concns. and mol. areas are calc. from Gibbs' adsorption isotherm. Lowering of γ for the 18, 42, 90, 186 members is a linear function of $\log c$. W. R. A.

Behaviour of cellulose in alkaline solutions.—See B., 1940, 728.

Dissolution of cellulose esters. IV. Relation of interaction between individual particles of solute to integral heat of dissolution of cellulose esters. Z. ROGOVIN and V. IVANOVA (Kolloid. Shurn., 1938, **4**, 19—30).—The integral heat of dissolution, q, of cellulose acetate or nitrate in $COMe_2$ increases with the concn., supposedly owing to diminishing dissociation of the micelles. For a given concn. of a given ester q is the smaller the larger is the particle size. The formation of dil. solutions of esters is accompanied by the absorption of an amount of heat which is the greater the higher is the degree of dissociation of the chains in the solution, and the longer are the chains. The dilution of swollen gels causes no material heat effect. R. C.

Variations of viscosity of sols of lyophilic colloids. IV. Cellulose-cuprammonium sols. F. M. SCHEMJAKIN and M. E. KUPERMAN (Kolloid. Shurn., 1938, **4**, 31—34).—The effect on η of various salts at concns. up to those required to produce visible coagulation has been measured. In general, η passes through a series of max. and min. with increasing salt concn. R. C.

Apparent molecular shape and mol. wt. of proteins, from viscosity and diffusion measurements. H. NEURATH and G. R. COOPER (J. Amer. Chem. Soc., 1940, **62**, 2248—2249).—The apparent mol. shapes (axial ratios for prolate and oblate ellipsoids) and mol. wt. have been deduced from η and diffusion measurements for cryst. lactoglobulin, cryst. carbohydrate-free serum-albumin, serum-glycoid, cryst. pepsin, and three euglobin-free horse pseudoglobulin fractions pptd. at p_H 5·2 by 1·36, 1·6, and 2·1M-$(NH_4)_2SO_4$. W. R. A.

Freezing of inorganic hydrogels. S. UNO (J. Soc. Chem. Ind. Japan, 1940, **43**, 197—198B).—A no. of gelatinous ppts., including metal hydroxides, carbonates, and sulphides, are converted into a compact form which readily settles and is easily filtered, by freezing in contact with the mother-liquor or H_2O. F. L. U.

Ageing of sols and gels. IV. Syneresis in mercury acetamide gels. E. M. PREIS (Kolloid. Shurn., 1938, **4**, 55—62).—The kinetics of syneresis in presence of KNO_3 are those of a unimol. heterogeneous reaction; the effect of temp. has been examined. R. C.

Controlled flocculation. D. L. TILLEARD (Proc. Physical Soc., 1940, **52**, 828).—Thin films of pastes consisting of fine solid particles dispersed in a viscous liquid show marked changes in dispersion under slow shear, the particles becoming packed in long cylindrical flocculates so fine and regularly spaced as to give bright diffraction spectra. N. M. B.

Kinetics of polymerisation and coagulation. A. V. DUMANSKI and J. D. FRIDMAN (Kolloid. Shurn., 1938, **4**, 67—76)—The processes of polymerisation and coagulation are analogous, the process of coagulation visualised by Smoluchowski's theory being identical with that of a chain reaction with branching chains. From this similarity the equation $\log_e M = \log_e M_0 + \alpha\tau$ has been deduced for a polymerisation process, where M_0 is the initial mol. wt., M that after time τ, and α a function of the temp. and η. Experiments on the polymerisation of C_6H_6 solutions of butadiene in presence of Na have given results for M agreeing with those obtained from η by Staudinger's method. It seems probable that the slowing down of polymerisation reactions in solution is largely due to solvation. The time-distribution curves for various polymerides in the above reaction have been obtained. R. C.

Electrolyte coagulation process. Influence of dilution of sol on adsorption of precipitating ions. H. B. WEISER and W. O. MILLIGAN (J. Amer. Chem. Soc., 1940, **62**, 1924—1930).—The effect of concn. of sol on the pptn. val. of electrolytes for relatively pure sols of $Cu_2Fe(CN)_6$, Fe_2O_3, and As_2S_3, and of the adsorption of pptg. ions at their respective pptn. vals., has been studied. With each sol marked variations from the rule of Burton and Bishop were observed. For a given sol the proportionate increase in stability towards pptg. electrolytes on dilution is, for electrolytes with univalent pptg. ions, generally > for those with multivalent pptg. ions, and increases with the purity of the sol. The Ostwald rule does not apply. W. R. A.

Irregular series of colloidal solutions by electrolytes. II. Mastic sol. N. SATA and S. ITO (Bull. Chem. Soc. Japan, 1940, **15**, 271—275).—Irregularities in the curves of stability of mastic sol against concn. of $FeCl_3$ are removed when the sol is purified by prolonged dialysis, and are not restored by subsequent addition of electrolytes. On the other hand addition of EtOH, MeOH, or $COMe_2$ restores the irregularity. Accordingly the irregularities are connected with the presence, in the colloid particles, of traces of EtOH arising from the mode of prep. F. J. G.

Periodic phenomena in the evaporation of solutions. G. F. SMITH (Proc. Leeds Phil. Soc., Sci. Sect., 1940, **3**, 603—608).—In the vac. evapor-

ation of very dil. solutions of certain salts the solute is deposited on the walls of the containing vessel in the form of very fine rings parallel to the surface of the liquid. The distance between the rings increases with the rate of evaporation. The mechanism of the production of the rings is considered, and a possible explanation given. A. J. M.

Ionisation in non-aqueous solvents. III. Formation of sulphides in methyl and in ethyl alcohol. W. L. German and T. W. Brandon (J.C.S., 1940, 1329—1333; cf. A., 1938, I, 458).—Investigation of the reactions between Na_2S and $AgNO_3$, CdI_2, $CuCl_2$, $HgCl_2$, $CoCl_2$, and $NiCl_2$ in anhyd. MeOH and EtOH shows that complete double decomp. takes place with the first three salts. With the last three salts double decomp. is incomplete, the ppts. being of the type $(RCl_2)_x,(RS)_y$. C. R. H.

Temperature variation of ionisation constants of weak electrolytes. H. S. Harned and R. A. Robinson (Trans. Faraday Soc., 1940, **36**, 973—978).—Out of 5 equations representing the temp. variation of ionisation const. (K) of weak electrolytes which have been compared with experimental data one, $-\boldsymbol{R}T \log_e K = A - CT + DT^2$, is selected on the grounds of ease of computation and of ability to represent the data within the limits of experimental error. The best data on K for H_2O are surveyed critically. F. L. U.

Dissociation of calcium and magnesium phosphates. I. Greenwald, J. Redish, and A. C. Kibrick (J. Biol. Chem., 1940, **135**, 65—76).—The titration of H_3PO_4 with NaOH in the presence of KCl, NaCl, $MgCl_2$, and $CaCl_2$ has been studied potentiometrically. No difference in behaviour is observed until 1 equiv. of NaOH is added, but thereafter solutions containing $MgCl_2$ or $CaCl_2$ are more acid than those containing KCl or NaCl, this being attributed to the formation of $MgHPO_4$ and $CaHPO_4$, which are slightly dissociated. The dissociation const. (K) of $MgHPO_4$ is given by $-\log_{10} K = 2{\cdot}50 - 2{\cdot}15\sqrt{\mu}$, where μ is the ionic strength, whilst that for $CaHPO_4$ is slightly higher. J. W. S.

Conductance, dissociation constant, and heat of dissociation of triethylamine in water. J. E. Ablard, D. S. McKinney, and J. C. Warner (J. Amer. Chem. Soc., 1940, **62**, 2181—2183).—Vals. of Λ and K have been determined for aq. NEt_3 of various concns. at 25°, 40°, and 50°. The mean heat of dissociation is 1280 g.-cal. per mol. W. R. A.

Thermodynamic properties of solutions of amino-acids and related substances. VI. Activities of some peptides in aqueous solution at 25°. E. R. B. Smith and P. K. Smith (J. Biol. Chem., 1940, **135**, 273—279).—The v.p. of aq. solutions of glycylglycine, triglycine, alanylglycine, glycylalanine, and alanylalanine have been determined at 25° by Robinson and Sinclair's isopiestic method (A., 1934, 1173), and the osmotic and activity coeffs. of the peptides are calc. It is shown that, as with the α-NH_2-acids (A., 1939, I, 144), the mol. change in the activity coeff. $-(\log \gamma)/C$ varies linearly with the change in the dielectric const. of the solution ϵ_0/ϵ. J. W. S.

Solubility of arsenious oxide in dilute solutions of hydrochloric acid and sodium hydroxide. Character of the ions of tervalent arsenic. Evidence for polymerisation of arsenious acid. A. B. Garrett, O. Holmes, and A. Laube (J. Amer. Chem. Soc., 1940, **62**, 2024—2028).—Measurements of the solubility of As_2O_3 at 25° in aq. NaOH (0·16—6M.) indicate the formation of AsO_2', HAs_2O_4', and $H_2As_3O_6'$ ions. The ionisation const. of H_3AsO_3 is $2{\cdot}4 \times 10^{-10}$. The system As_2O_3–HCl has also been investigated (HCl 0·04—8·1M.). Min. solubility occurs in 3—4M-HCl; AsOCl appears to be the principal mol. present at concn. of HCl of 3—6·5M. Assuming As_2O_3 as solid phase the hydrolysis const. of $AsCl_3$ has been calc. W. R. A.

Curve representing yield of undissociated compound in binary systems. V. J. Anosov (Ann. Sect. Anal. Phys.-Chim., 1940, **12**, 15—17).—Theoretical. R. T.

Phase equilibria in hydrocarbon systems. Methane–*n*-butane system in the two-phase region. B. H. Sage, B. L. Hicks, and W. N. Lacey (Ind. Eng. Chem., 1940, **32**, 1085—1092).—The compositions and the sp. vols. of the coexisting phases of the system CH_4–n-C_4H_{10} have been determined at 70—250° and at various pressures covering the full two-phase region. Gas–liquid equilibrium consts. and the fugacities of the components are derived. J. W. S.

Organic molecular compounds. III. Molecular compound formation of aromatic hydrocarbons with nitro-compounds and with antimony trihalides. C. Shinomiya (Bull. Chem. Soc. Japan, 1940, **15**, 259—270).—M.p. data are given for binary systems consisting of pyrene (A) or fluoranthene (B) with s-$C_6H_3(NO_2)_3$ (C), picramide (D), trinitrocresol (E), 1 : 2 : 4 : 6-$C_6H_2Me(NO_2)_3$ (F), picryl chloride (G), 2 : 4-$(NO_2)_2C_6H_3$·OH (H), 1 : 2 : 4-$C_6H_3Me(NO_2)_2$ (K), 2 : 4 : 6-$(NO_2)_3C_6H_2$·OMe (L), p-$C_6H_4(NO_2)_2$ (M), or m-$C_6H_4(NO_2)_2$ (N), and of A, B, acenaphthene (P), anthracene (Q), phenanthrene (R), or fluorene (S) with 1 : 2 : 4 : 6-$C_6H_2(NO_2)_4$ (T). The following *compounds* are recorded: AC, m.p. 245·5°; BC, m.p. 205·0°; AD, m.p. 236·0°; BD, m.p. 191·5°; AE, m.p. 163·0°; BE, m.p. 144·0°; AF, m.p. 164·5°; BF, m.p. 133·0°; AG, m.p. 154·0°; BG, m.p. 120·0°; AH, m.p. 146·3°; BH, m.p. 92·0°; AK, m.p. 92·5°; BK, m.p. 75·5°; AL, m.p. 104·5°; BL, m.p. 75·0°; AM; AN, m.p. 92·7°; AN, m.p. 89·3°; BN, m.p. 77°; AT, m.p. 168·5°; BT, m.p. 134·0°; PT, m.p. 110·5°; QT, m.p. 171·0°; R_2T_3, m.p. 125·0°; RT; ST_2, m.p 130·0°; $3C,2C_6HMe_5$, m.p. 121·0°; C,4 : 4′-$(C_6H_4Me)_2$, m.p. 91·0°; picric acid–stilbene, 1 : 1, m.p. 93·0°; $C,2NHPh_2$, m.p. 100·0°. These are tabulated and compared with known analogous compounds, and with mol. compounds between aromatic hydrocarbons and $SbCl_3$ or $SbBr_3$. F. J. G.

Systems magnesium chromate–water and ammonium chromate–water from 0° to 75°. A. E. Hill, G. C. Soth, and J. E. Ricci (J. Amer. Chem. Soc., 1940, **62**, 2131—2134).—The aq. solubilities of $MgCrO_4$ and $(NH_4)_2CrO_4$ have been determined from 0° to 75°. The saturating phases of the

$MgCrO_4$–H_2O system are $MgCrO_4,7H_2O$ and $MgCrO_4,5H_2O$, the transition temp. for the two hydrates in contact with solution being 17·2° at 35·15% $MgCrO_4$. From the loss in wt. of $MgCrO_4,5H_2O$ at different temp. the following transitions have been recorded: $5H_2O \rightleftharpoons 2H_2O$ (50—60°); $2H_2O \rightleftharpoons H_2O$ (100—110°); $H_2O \rightleftharpoons$ anhyd. (160—170°). W. R. A.

Geometrical transformations of components of binary and ternary systems, involving formation of compounds. V. P. Schischokin (Ann. Sect. Anal. Phys.-Chim., 1940, **12**, 5—10).—Geometrical methods of representating transformations are explained. R. T.

Two-phase equilibrium in binary and ternary systems. II. System methane–ethylene. III. System methane–ethane–ethylene. M. Guter, D. M. Newitt, and M. Ruhemann (Proc. Roy. Soc., 1940, **A**, **176**, 140—152).—The liquid–vapour equilibria of the systems were determined over a wide range of pressure at temp. between 0° and —104°. G. D. P.

Physico-chemical analysis of the mutual system $2NaCl + MgSO_4 \rightleftharpoons Na_2SO_4 + MgCl_2$, as applied to salt lakes. I. Annual cycles of Lake Elton. I. B. Feigelson and A. G. Bergman (Ann. Sect. Anal. Phys.-Chim., 1940, **12**, 157—188).—Phase diagrams are given for the system at 5° intervals from —20° to 35°. The results are applied to the conditions prevailing in Lake Elton (cf. A., 1940, I, 421). R. T.

20° isotherm of the ternary system: manganous nitrate–nitric acid–water. W. W. Ewing and C. F. Glick (J. Amer. Chem. Soc., 1940, **62**, 2174—2176).—The system $Mn(NO_3)_2$–HNO_3–H_2O has been investigated at 20°. The following hydrates exist in stable equilibrium with HNO_3 at 20°: 6, 4, 2, 1·5, 1, 0·5H_2O. No evidence of the tri- or hemipentahydrate was obtained. W. R. A.

Equilibrium of system NH_3–P_2O_5–SO_3–H_2O. I. Ternary systems $(NH_4)_2SO_4$–H_3PO_4–H_2O and $(NH_4)_2SO_4$–$(NH_4)_2H_3SO_4PO_4$–H_2O. II. Ternary system $(NH_4)_2SO_4$–$NH_4H_2PO_4$–H_2O. III. Ternary system $NH_4H_2PO_4$–H_3PO_4–H_2O and the quaternary system $NH_4H_2PO_4$–$(NH_4)_2H_3SO_4PO_4$–H_3PO_4–H_2O. S. Uno (J. Soc. Chem. Ind. Japan, 1940, **43**, 168—169B, 169B, 170B).—I. Data for the former system at 25° and 70° indicate the formation of $(NH_4)_2H_3SO_4PO_4$. Data for the latter system at 0°, 25°, 40°, 70°, and 100° are recorded.

II. Data for this system at 0°, 25°, 40°, 70°, and 100° do not indicate double salt formation.

III. Data for these two systems at 25° and 70° are recorded. Data for the system $(NH_4)_2H_3SO_4PO_4$–H_3PO_4–H_2O at 25° and 70° have been calc. from data in part I. C. R. H.

Double decomposition in absence of a solvent. XLVII. Fusion diagrams of ternary systems of fluorides, chlorides, and sulphates of potassium and sodium. S. Mukimov. **XLVIII. Mutual irreversible system of nitrates and sulphates of potassium and thallium. XLIX. Ternary system: sodium, potassium, and thallium nitrates.** P. K. Leman. **L. Complex mutual system: potassium and thallium nitrates, chlorides, and sulphates.** A. P. Rostkovski (Ann. Sect. Anal. Phys.-Chim., 1940, **12**, 19—38, 39—50, 51—56, 57—63).—XLVII. Fusion diagrams are given for the binary systems KF–K_2SO_4 and –KCl, KCl–K_2SO_4, NaCl–Na_2SO_4 and –NaF, and NaF–Na_2SO_4, and the ternary systems KF–KCl–K_2SO_4 and NaF–NaCl–Na_2SO_4. The only compounds noted are of the type MF,M_2SO_4 (M = Na, K).

XLVIII. Fusion diagrams are given for the system $2KNO_3 + Tl_2SO_4 \rightleftharpoons 2TlNO_3 + K_2SO_4$, involving the binary systems $TlNO_3$–Tl_2SO_4 and –KNO_3, and K_2SO_4–Tl_2SO_4 and –KNO_3.

XLIX. The fusion diagram of the system $NaNO_3$–KNO_3–$TlNO_3$ suggests solid solution, but not compound, formation; the ternary eutectic is at 138° ($NaNO_3$ 25, KNO_3 24, and $TlNO_3$ 51 mol.-%).

L. Two sections of the prism representing the system KCl–KNO_3–K_2SO_4–TlCl–$TlNO_3$–Tl_2SO_4 have been studied. Solid solutions, but not compounds, are formed. R. T.

Equilibria in liquid iron with carbon and silicon.—See B., 1940, 740.

Energies of isomerisation of hexanes. F. D. Rossini and E. J. R. Prosen (J. Amer. Chem. Soc., 1940, **62**, 2250—2251).—The heats of combustion of the five isomeric hexanes have been determined and, from the data, the energies of isomerisation at 0° and 25° for both liquid and gaseous states have been calc. in terms of the relative energy content referred to n-C_6H_{14} as zero. There is a marked difference between β- (I) and γ-methylpentane (II); the difference between n-C_6H_{14} and βγ-dimethylbutane is approx. the sum of the differences between n-C_6H_{14} and (I) and n-C_6H_{14} and (II); the difference between n-C_6H_{14} and ββ-dimethylbutane is approx. the same as that between n-C_5H_{12} and CMe_4. Some thermodynamic vals. are calc. W. R. A.

Ionic entropies and free energies and entropies of solvation in water–methanol solutions. W. M. Latimer and C. M. Slansky (J. Amer. Chem. Soc., 1940, **62**, 2019—2023).—Ionic entropies, free energies and entropies of solvation have been calc. for the pairs of ions $Na^{\cdot} + Cl'$, $K^{\cdot} + Cl'$, and $K^{\cdot} + Br'$ in H_2O–MeOH mixtures and vals. are discussed with reference to the nature of the solvation process. Free energies of solvation decrease in the range from pure H_2O to pure MeOH in approx. agreement with the change in dielectric const. Although energies of solvation in MeOH are $<$ in H_2O, entropies in MeOH are $\gg$ in H_2O. Tentative explanations are advanced. W. R. A.

Electrolytic solutions. XXII. Conductance of ethylene dichloride solutions of quaternary ammonium salts having large negative ions. D. L. Fowler and C. A. Kraus (J. Amer. Chem. Soc., 1940, **62**, 2237—2240).—Λ of $NBu^{a}_4\cdot OH,BPh_3$, NBu^{a}_4F,BPh_3, $NMe_4\cdot OH,BPh_3,EtOH$, $NMe_4\cdot OH,BPh_3,H_2O$, and NMe_4F,BPh_3 at 25·00° in $(CH_2Cl)_2$ have been measured and are discussed. The complex fluoride is more stable than the corresponding hydroxide. Dissociation consts. of ion–ion pairs are computed. W. R. A.

Mechanism of hydrogen electrode process. A. FRUMKIN (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 473—477).—A reply to Horiuti *et al.* (A., 1938, I, 255; 1939, I, 340). W. R. A.

Mixed potentials at the dropping mercury electrode. I. M. KOLTHOFF and C. S. MILLER (J. Amer. Chem. Soc., 1940, **62**, 2171—2174).—The significance of "mixed potentials" at the dropping Hg electrode is explained and illustrated by suitable examples and its importance in polarographic studies is discussed. The principle of a new type of amperometric titration in which the titrating media do not react chemically is described. Current–voltage curves for air-saturated solutions of 0·1N-NaOH with air-free Na_2S in the same medium, mixtures of O_2 and KCN in dil. NaOH, an air-free mixture of benzoquinone and HCN, and TlCl and KCN in NaOH are given and briefly discussed. W. R. A.

Electrochemical–acoustic phenomena. III. Possible causes of reception of sound by polarised electrodes. IV. Reception of sound by semi-permeable membranes. L. V. NIKITIN (J. Gen. Chem. Russ., 1940, **10**, 97—101, 102—111; cf. A., 1936, 938; 1937, I, 141).—III. Possible explanations of the electro-acoustic effect are discussed.

IV. Currents are generated in collodion diaphragms between electrodes when notes of certain frequencies are sounded. The range of frequencies to which the membranes are sensitive extends with rising c.d., this applying to both the upper and the lower limit in the case of the cell Cu|0·1N-$CuSO_4$⁞0·1N-$CuSO_4$|Cu, and to the upper limit only in the case of Pt|0·001N-KCl⁞0·001N-KCl|Pt. Raising the concn. of the electrolyte raises both the upper and the lower limits of c.d. at which reception of sound is possible. The results support the view that sound-receptivity is a function of a semipermeable membrane forming on polarised electrodes. R. T.

Preferential and initial ionic recombination in gases. N. E. BRADBURY (J. Appl. Physics, 1940, **11**, 267—273).—Mathematical. A theory for the processes involved in preferential and initial ionic and electronic recombination is developed. J. W. S.

Rôle of free radicals in mechanisms of gaseous explosions. A. R. UBBELOHDE (Chem. and Ind., 1940, 657—659).—Previously suggested mechanisms for the combustion of hydrocarbons are discussed in the light of experimental knowledge of free radicals. The dissipation of energy from reacting mols. by third-body collisions, and localisation of radicals in "reaction cells," are also discussed briefly. A. J. E. W.

Explosive reactions of gases. I. Thermal explosion of oxy-hydrogen gas at low pressures. S. HORIBA and R. GOTO (Proc. Imp. Acad. Tokyo, 1940, **16**, 218—222).—Experiments in which the gas ($H_2 : O_2 = 2 : 1$) contained in a spherical glass vessel is heated internally with a Pt strip or externally indicate that the low-pressure explosion is not a homogeneous process in the gas phase. H_2O vapour retards the explosive reaction, the retardation taking place on the surface of the containing vessel. D. F. R.

Effect of surface on cool flames in the oxidation of propane. R. A. DAY, jun., and R. N. PEASE (J. Amer. Chem. Soc., 1940, **62**, 2234—2237).—The cool-flame region in 1 : 1 C_3H_8–O_2 mixtures has been investigated. The surface effects resulting from treatment of the reaction tube with KCl, HF, and HNO_3 are negligible. Possible mechanisms are discussed. W. R. A.

Homogeneous first-order gas reactions. XI. Decomposition of benzylidene diacetate, o-chlorobenzylidene diacetate, and benzylidene dibutyrate. N. A. D. PARLEE, J. C. ARNELL, and C. C. COFFIN (Canad. J. Res., 1940, **18**, **B**, 223—230; cf. A., 1939, I, 375).—Benzylidene and *o*-chlorobenzylidene diacetate and benzylidene dibutyrate decompose unimolecularly about six times as rapidly as ethylidene diacetate, at rates given by the equation previously found for crotonylidene and furfurylidene diacetates, viz., $k_1 = 1{\cdot}3 \times 10^{11}e^{-33{,}000/RT}$. The esters with this identical reaction velocity all have a double bond at the same distance from the breaking point of the mol. D. F. R.

Effect of substitution on thermal decomposition of gaseous benzaldehyde. R. E. SMITH (Trans. Faraday Soc., 1940, **36**, 983—987; cf. A., 1940, I, 259).—Substitution in the *p*-position of Me or of Cl produces only slight change in the rates of the two reactions in the thermal decomp. of PhCHO. The effect of NO_2 cannot be inferred since the mechanism of decomp. of *m*-NO_2·C_6H_4·CHO resembles that of $PhNO_2$ rather than that of PhCHO. Data for the decomp. of $PhNO_2$ vapour at 500° are recorded. F. L. U.

Rate of exchange of elementary radiosulphur with sulphur monochloride. R. A. COOLEY and D. M. YOST (J. Amer. Chem. Soc., 1940, **62**, 2474—2477).—At room temp. the rate of exchange of S* between S_8 and S_2Cl_2 is slow but at 100° proceeds at a measurable rate $\propto [S_8]$. The rate-determining step is the slow reversible dissociation $S_8 \rightleftharpoons S_6 + S_2$ and the exchange is effected by the rapid reversible reaction $S_2 + S_2Cl_4 \rightleftharpoons 2S_2Cl_2$. W. R. A.

Condensations of carbonyl compounds. Kinetic study of the reaction of acetophenone with benzaldehyde. (MISS) E. COOMBS and D. P. EVANS (J.C.S., 1940, 1295—1300).—The velocity of the condensation of PhCHO to COPhMe can be represented by $v = k$[PhCHO][COPhMe][OEt′]. *p*-Substitution of OMe and Cl respectively increases and decreases v as a result of a respective decrease and increase in the energy of activation (E). *p*-Substitution of OMe and Cl into COPhMe respectively decreases and increases v, not as a result of changes in E, but as a result of a respective decrease and increase in the val. of PZ in the term $PZ.e^{-E/RT}$. Of two reaction mechanisms discussed, the more probable one involves a reaction between PhCHO and OEt′ followed by a reaction between the resulting complex ion and a suitably oriented COPhMe mol. C. R. H.

Kinetics of the degradation of polyesters by alcohols. P. J. FLORY (J. Amer. Chem. Soc., 1940, **62**, 2255—2261).—A method for studying the kinetics of polymeride degradation of polyesters from measure-

ments of η, based on the postulate that ester groups of polymeride mols. are attacked at random, has been devised. For the degradations of decamethylene adipate polyesters by decamethylene glycol and by lauryl alcohol the rate of reaction $\propto$ the concn. of acid catalyst, and the rate coeffs. decrease slightly with increasing concn. of OH groups. W. R. A.

Rate and mechanism in the reactions of benzyl chloride with water, hydroxyl ion, and acetate ion. G. W. BESTE and L. P. HAMMETT (J. Amer. Chem. Soc., 1940, **62**, 2481—2487).—The rates of first-order solvolytic reaction of CH_2PhCl and of its second-order reactions with OH′ and OAc′ ions in dioxan–H_2O (60·72 : 39·28) at 50° have been measured. Pronounced salt and medium effects with relatively small changes in the nature of the medium were found, the sp. rates varying with initial concn. of reactants. Both Cl′ and OAc′ ions retard the solvolytic reaction, the mechanism of which is discussed. W. R. A.

Kinetics of saponification of ethyl esters of several phenyl-substituted acids. H. S. LEVENSON and H. A. SMITH (J. Amer. Chem. Soc., 1940, **62**, 2324—2327).—The kinetics of saponification in 85% aq. EtOH for Et phenylacetate, β-phenylpropionate, γ-phenylbutyrate, δ-phenylvalerate, hydratropate, phenylethyl-, diphenyl-, and *cyclo*hexyl-acetate at 25°, 35°, 45°, and 55° have been investigated. The negative inductive effect of Ph is indicated and the steric influence of α-substituted Ph on the rate and activation energy affects the reaction kinetics to a greater extent than polarisation effects due to Ph. W. R. A.

Electrostatic influence of substituents on reaction rates. II. F. H. WESTHEIMER (J. Amer. Chem. Soc., 1940, **62**, 1892—1895; cf. A., 1940, I, 222).—The Kirkwood–Westheimer electrostatic equations have been applied successfully to the calculation of the effect of *p*-substituents on the rate of saponification of phenylacetic, β-phenylpropionic, benzoic, and cinnamic esters, to the rate of alkaline hydrolysis of benzamides, and to reaction rate of $CHPh_2Cl$ with NaI. An approx. expression has been derived for dipole–dipole interaction, and accounts satisfactorily for substituent effects on alkylation rate of NMe_3 by substituted Me benzoates. W. R. A.

Mechanism of Wurtz reaction. R. B. RICHARDS (Trans. Faraday Soc., 1940, **36**, 956—960).—The rate of reaction of Na with EtI in C_6H_{14} at the b.p. $\propto$ [EtI], with a const. excess of Na. Increase in the surface area of the Na with const. initial [EtI] causes a reduction in the yield of C_4H_{10} and an increase in that of C_2H_6, the yield of C_2H_4 being little affected. Under similar conditions EtI reacts ~7 times as fast as $Pr^{\beta}I$. It is inferred that an initial reaction of 1 mol. of EtI with Na gives rise to Et, which then reacts with EtI to give C_4H_{10}, or with another Et to give $C_2H_6 + C_2H_4$. Side reactions of Et with C_2H_4 and with C_6H_{14} probably occur, since small amounts of resinous hydrocarbons are formed. F. L. U.

Kinetics of decomposition of benzenediazonium chloride in water. E. A. MOELWYN-HUGHES and P. JOHNSON (Trans. Faraday Soc., 1940, **36**, 948—956).—The rate of decomp. of purified PhN_2Cl in aq. solution at 288° and 333° K. conforms to a simple unimol. law, the temp.-variation of the velocity coeff. being given by $\log_e k = C + (J/\boldsymbol{R})\log_e T - E/\boldsymbol{R}T$, where J is −36 g.-cal. per mol. PhCl was not formed during the experiments. The rate of decomp. is increased by large concns. of HCl or of PhOH. F. L. U.

Kinetics of oxidation of organic compounds by potassium permanganate. II. 2 : 6-Dinitrophenol. E. A. ALEXANDER and F. C. TOMPKINS (J. S. African Chem. Inst., 1940, **23**, 33—40).—Apparatus for measuring the amount of gas evolved during a chemical reaction is described, and used to investigate the oxidation of 2 : 6-dinitrophenol (I) by $KMnO_4$. Addition of F′ decreases the rate of oxidation, and shows that MnO_4' plays no part in it. Addition of $MnSO_4$ shows that $Mn^{\cdot\cdot\cdot\cdot}$ is the most important factor, and max. acceleration in the rate is obtained when $Mn^{\cdot\cdot} : MnO_4'$ is 0·5. There is then no induction period, and the reaction is bimol. Below a certain p_H the addition of MnO_2, pptd. from $Mn^{\cdot\cdot}$ and MnO_4', produces an acceleration $\propto$ $[H^{\cdot}]^2 \times$ [MnO_2 in solution]. (I) forms a complex with $Mn^{\cdot\cdot\cdot}$, but complex formation plays little part in the oxidation. A yellow intermediate oxidation product, m.p. 91°, has been isolated. Previous conclusions concerning the mechanism of the oxidation (A., 1939, I, 570) are supported by the new measurements. L. S. T.

Rate of nitration of benzene.—See B., 1940, 724.

Carbamide. III. Hygroscopicity of carbamide and inorganic salts. W. SAKAI (J. Soc. Chem. Ind. Japan, 1940, **43**, 190B; cf. A., 1940, I, 354).—The rate of absorption of H_2O from the atm. by $CO(NH_2)_2$ or by any H_2O-sol. solid $\propto$ the surface area and the difference between the partial pressure of H_2O vapour in the atm. and the v.p. of a saturated solution of the solid. Under certain conditions, however, solids may be non-hygroscopic even when this difference has a small positive val. F. L. U.

Physico-chemical conditions of dissolution of gold and its alloys in solutions of cyanides. I. I. N. PLAKSIN and S. K. SCHABARIN (Ann. Sect. Anal. Phys.-Chim., 1940, **12**, 65—84).—The curve connecting velocity of dissolution, v, of Au or 9 : 1 Au–Ag with [KCN] is made up of an ascending, a horizontal, and a descending branch; these correspond, respectively, with conditions of excess of O_2 over KCN, equality of [O_2] with [KCN], and excess of KCN over O_2. Max. v is obtained with 0·2—0·3% KCN. When the metal is rotated the val. of v rises, with increasing velocity of rotation, to a max. depending on the nature of the metal (Au–Ag > Au–Cu > Au) and on the [KCN]. Addition of H_2O_2 may cause increase in v, by effecting depolarisation, or may diminish v as a result of formation of an oxide film on the metal. R. T.

Catalytic effect of osmium compounds on the reduction of perchloric acid by hydrobromic acid. W. R. CROWELL, D. M. YOST, and J. D. ROBERTS (J. Amer. Chem. Soc., 1940, **62**, 2176—2178).—The reaction between $HClO_4$ and HBr is catalysed by Os^{IV} compounds. Using K_2OsBr_6, rate experiments show that the rate $\propto$ [Os^{IV}], [ClO_4'],

[H˙]; and, in the later stages, ∝ [Br′]. A mechanism is advanced, the rate-determining step being $OsBr_6''$ + $H^{\cdot}$ + ClO_4' → $OsBr_6OH'$ + ClO_3'. W. R. A.

Comparison of esterification and ester interchange kinetics. P. J. Flory (J. Amer. Chem. Soc., 1940, **62**, 2261—2264).—Rate coeffs. and activation energies for the acid-catalysed polyesterification of adipic acid by decamethylene glycol (I) and the alcoholysis of decamethylene adipate polyester by (I) are given. For carboxylic acids as catalysts at 109° the rate coeffs. are approx. equal, whilst for *p*-$C_6H_4Me\cdot SO_3H$ as catalyst at 109° the rate coeff. for polyesterification is ~11 times the rate coeff. for alcoholysis, the activation energies being 12, 150, and 11,150 g.-cal., respectively. W. R. A.

Base-catalysed prototropy of substituted acetones. R. P. Bell and O. M. Lidwell (Proc. Roy. Soc., 1940, **A**, **176**, 88—113).—The halogenation velocity at 25° was measured for $COMe_2$, $(CH_2Ac)_2$, $COMe\cdot CH_2Cl$, $COMe\cdot CH_2Br$, $COMe\cdot CHCl_2$, and CH_2Ac_2 The catalysts studied were the anions of $CH_2Cl\cdot CO_2H$, $OH\cdot CH_2\cdot CO_2H$, AcOH, and $Bu^{\gamma}CO_2H$. The consts. of the Brönsted equation are evaluated, and the exponent is found to decrease as the reactivity of the ketone increases. The catalytic coeffs. of the H_2O mol. are deduced; the OH′ ion is much less effective as a catalyst than theory predicts. G. D. P.

Potential energy curves in proton transfer reactions. R. P. Bell and O. M. Lidwell (Proc. Roy. Soc., 1940, **A**, **176**, 114—121).—The potential energy curves involved in proton transfer reactions are discussed with special reference to the base-catalysed prototropy of ketones. The assumption of covalent binding fails to account for the relations observed between basic strength and catalytic power. Approx. calculations show that the ionic state is of importance and the energy curves deduced give a more satisfactory picture of the experimental facts (cf. preceding abstract). G. D. P.

Acid catalysis in non-aqueous solvents. IX. Mutarotation of α-nitrocamphor in chlorobenzene solution. R. P. Bell and J. A. Sherred (J.C.S., 1940, 1202—1205).—The catalytic activity of five org. acids in the mutarotation of α-nitrocamphor in PhCl measured at 25° shows that the reaction is of the first order and that there is an approx. linear relation between log catalytic const. and log dissociation const. in H_2O. Discussion of the mutarotation mechanism suggests that it is analogous to the inversion of menthone and to the mutarotation of α-chloro- and α-bromo-camphor, *i.e.*, the interconversion of two stereoisomerides rather than of a normal nitro- and an *aci*-nitro-form. C. R. H.

Oxidation of ascorbic acid by ogygen with cupric ion as catalyst. A. O. Dekker and R. G. Dickinson (J. Amer. Chem. Soc., 1940, **62**, 2165—2171).—The oxidation of ascorbic acid (I) by O_2 in presence of Cu˙˙ ions ∝ [(I)], [Cu˙˙], and inversely ∝ $[H^{\cdot}]^2$. The ascorbate ion appears to be initially oxidised by Cu˙˙ ions to a semiquinone-like ion which is immediately oxidised by O_2 to dehydroascorbic acid. The [Cu˙˙] is maintained const. by the oxidation of Cu˙ ions by O_2. The sp. reaction rate increases during the reaction owing to the accumulation of H_2O_2 formed when Cu˙ ions are oxidised by O_2. Addition of Fe˙˙˙ ions accelerates the reaction markedly. W. R. A.

Activation of phosphatases.—See A., 1940, III, 767.

Heteropoly-acids as catalysts for vapour-phase partial oxidation of naphthalene. M. M. Marisic (J. Amer. Chem. Soc., 1940, **62**, 2312—2317).—The use of heteropoly-acid catalysts for the partial oxidation of $C_{10}H_8$ to $(:CH\cdot CO)_2O$ and *o*-$C_6H_4(CO)_2O$ has been investigated at a no. of temp. between 300° and 520°, using different mol. ratios of $C_{10}H_8$ to air, space velocities, and times of contact. The efficiencies of V_2O_5 and phosphomolybdic acid are approx. equal but < that of a catalyst prepared from NH_4 phosphovanadotungstate. MoO_3 was promoted by P, Sn, and Si but " poisoned " by As, Ni, and Cr, all of which promote the oxidation of the primary reaction products. W. R. A.

Catalytic reactions. A. J. Currier (J. Chem. Educ., 1940, **17**, 262—267).—Autocatalytic reactions, especially the drying of linseed oil in presence of metallic salts of org. acids, are discussed. L. S. T.

Catalytic hydrogenation with deuterium. D. Rittenberg, S. Ratner, and H. D. Hoberman (J. Amer. Chem. Soc., 1940, **62**, 2249—2250).—When maleic acid is catalytically hydrogenated by shaking with active Pd or Pt in H_2O with D_2 gas the succinate ion (I) formed has a D content 3—5 times that of the liquid phase. Conversely, when the system contains D_2O and H_2 gas (I) has practically no D. The reaction is faster than that between H_2 and H_2O but the mechanism is unknown. Reduction of α-keto-glutaric acid (i) with H_2 in an ammoniacal solution of 6·7% D_2O with Pd gave a glutamic acid, $C_5H_{8\cdot963}D_{0\cdot037}O_4N$, yielding, on degradation with chloramine-*T*, a Ba succinate, $C_4H_{3\cdot964}D_{0\cdot036}O_4Ba$; and (ii) with D_2 in ordinary H_2O gave a glutamic acid, $C_5H_{7\cdot61}D_{1\cdot39}O_4N$, and the corresponding Ba succinate, $C_4H_{2\cdot87}D_{1\cdot13}O_4Ba$. From these data it is calc. that the α- and β-H atoms contained 26 and 56 at.-% D respectively. The significance of the results is discussed. W. R. A.

Catalytic formation of potassium nitrite from potassium nitrate in liquid ammonia. F. W. Bergstrom (J. Amer. Chem. Soc., 1940, **62**, 2381—2384).—KNH_2 reduces KNO_3 in liquid NH_3 to KNO_2 thus: $3KNH_2 + 3KNO_3 = 3KOH + 3KNO_2 + N_2 + NH_3$, particularly in the presence of Fe_2O_3, Co_2O_3, NiO, and CuO. Mn_3O_4 is less effective, and Cr_2O_3, Al_2O_3, ZnO, and Fe wire are poor catalysts. Since KOH catalyses the reduction slightly the above equation appears to be autocatalytic. The catalysts react with KNH_2 to give KOH and K ammonometallates, *e.g.*, $CuNK_2,xNH_3$. In liquid NH_3 there is a slow reaction between KNH_2 and KNO_2, giving KOH and N_2, in the presence of Co_2O_3 and Fe_2O_3. KN_3 is not formed in reactions catalysed at room temp. but is formed at higher temp. when the catalyst is absent. W. R. A.

Catalytic dehydrogenation of representative hydrocarbons. A. G. Oblad, R. F. Marschner,

and L. HEARD (J. Amer. Chem. Soc., 1940, **62**, 2066—2069).—Representative hydrocarbons of all classes have been dehydrogenated over Cr oxide catalysts under identical high-rate, high-temp. conditions. *cyclo*Hexanes are converted into aromatic hydrocarbons and practically no residual products are formed. Paraffins are much less rapidly converted than *cyclo*hexanes and C is deposited and catalyst activity steadily decreases. Olefines are more readily converted than paraffins, but the decrease in activity and deposition of C are more pronounced. *cyclo*-Pentanes dehydrogenate slowly and large amounts of C are deposited. Simple methylated aromatic hydrocarbons are unaffected, but alkylated aromatic hydrocarbons are slowly dehydrogenated to products which readily poison the catalyst. W. R. A.

Oxidation of sulphur dioxide at an activated vanadium catalyst. Stability of various vanadium catalysts.—See B., 1940, 736.

Catalytic activity of phthalocyanines in autoxidation of linseed oil and methyl linoleate.—See B., 1940, 745.

Electrochemical oxidation of cobalt. E. S. MITZELOVSKI and B. F. ORMONT (J. Gen. Chem. Russ., 1940, **10**, 161—164).—The oxide obtained by anodic oxidation of Co (c.d. 100—1500 amp. per sq. dm., at 33—150°) is a mixture of Co_2O_3 and CoO_2. R. T.

Variables in silver-plating solutions.—See B., 1940, 742.

Electrolytic production of manganese.—See B., 1940, 743.

Chemical action of electric discharges. XIX. Production of hydrocyanic acid and ammonia by the action of the high- and low-frequency electric arc on mixtures of nitrogen, carbon monoxide, and hydrogen at ordinary and low pressure. E. BRINER and H. HOEFER (Helv. Chim. Acta, 1940, **23**, 826—831; cf. A., 1938, I, 150).—The energy yields of the production of HCN under the above conditions or between electrodes covered with C are $\ll$ those obtained with hydrocarbon (I) mixtures. C or hydrocarbon radicals formed by the action of the arc on (I) are very suitable for the production of HCN. The formation of HCN and NH_3 is greatly favoured by the association of high frequency of arc and low pressure of gas. H. W.

Electrochemistry of gases. K. G. EMELEUS and J. W. BECK (Proc. Roy. Irish Acad., 1940, **46**, 49—63).—The formation of wall deposits on passage of a discharge through C_6H_6, $C_{10}H_8$, and thiophen vapours in the presence of He, and through C_2H_2, has been investigated. Observed regularities in the position of the deposits are discussed theoretically. No information as to the charged or neutral nature of the particles forming the deposit could be obtained by means of Langmuir probes. On passage of a discharge through a mixture of N_2 and H_2 in a tube cooled in liquid air, condensation occurred when the negative glow was close to the wall. On evaporation the condensed film gave rise to some permanent gas as well as to NH_3. O. D. S.

Theory of photographic latent image formation. J. H. WEBB (J. Appl. Physics, 1940, **11**, 18—34).—Theories of the mechanism of the production of the photographic latent image are summarised and discussed. J. W. S.

Relation of light intensity to lateral growth on a photographic plate. H. S. COLEMAN and H. L. YEAGLEY (J. Amer. Chem. Soc., 1940, **62**, 2246—2247).—The dependence of diameter of photographic images of stars (artificial and natural) on several parameters has been investigated. A certain discrepancy in reciprocity with respect to the relation between diameter, time, and intensity was noticed. Time and temp. of development, time and intensity of exposure, and plate characteristics are varied independently. W. R. A.

Mercury-photosensitised reactions of propane. E. W. R. STEACIE and D. J. DEWAR (J. Chem. Physics, 1940, **8**, 571—576).—The Hg-photosensitised decomp. of C_3H_8 alone and in presence of H_2 has been investigated at temp. between 24° and 323°. The products of reaction are almost entirely H_2 and hexanes (Pr^{β}_2 and $Pr^{a}Pr^{\beta}$). At 25° the quantum yield of H_2 is 0·15 and this val. increases at higher temp. The following mechanism is postulated $Hg(^3P_1) + C_3H_8 \rightarrow Hg(^1S_0) + Pr + H$; $Hg(^3P_1) + H_2 \rightarrow Hg(^1S_0) + 2H$; $H + C_3H_8 \rightarrow Pr + H_2$; $Pr \rightarrow C_6H_{14}$; $2H \rightarrow H_2$; $Pr + C_3H_8 \rightarrow C_6H_{14} + H$. W. R. A.

Photochemical studies. XXXI. Systematic study of the near ultra-violet photochemical decomposition of acetone. D. S. HERR and W. A. NOYES, jun. **XXXII. Photochemical reaction between nitrous oxide and hydrogen.** J. W. ZABOR and W. A. NOYES, jun. (J. Amer. Chem. Soc., 1940, **62**, 2052—2059, 1975—1981).—XXXI. Using both 3130 and 2537 A. the primary process of decomp. in $COMe_2$ seems to be $COMe_2 + h\nu = Ac + Me$ and it is followed by (*a*) the spontaneous dissociation of some Ac radicals to give Me + CO, particularly at lower temp., (*b*) the decomp. of Ac radicals, particularly at high temp., to Me + CO, (*c*) diffusion of Ac radicals to the walls and dimerisation to Ac_2, (*d*) a homogeneous gas-phase reaction between Me and Ac radicals giving $COMe_2$, and (*e*) diffusion of Me radicals to the wall with production of C_2H_6. Quantum yields of CO and C_2H_6 formation and of $COMe_2$ disappearance have been determined for different temp., pressure, and intensities. The above mechanism accounts for the variation of quantum yield with λ. The most probable val. for the activation energy of the dissociation of Ac into CO and Me is 18 kg.-cal.

XXXII. In the photochemical reaction between N_2O and H_2, H_2O and NH_3 are both formed, thus suggesting that probably two primary reactions take place: $N_2O + h\nu = N_2 + O$ and $N_2O + h\nu = NO + N$. The quantum yield of H_2O increases as the pressure of H_2 is increased and approaches 1 at room temp. NO is not produced when sufficient H_2 is present; addition of NO prevents formation of NH_3 but first lowers and then increases the quantum yield of H_2O. The mechanism is very complex and a scheme which accounts qualitatively for the data is advanced. Temp. has a profound effect on the

reaction, which appears to change its character as temp. rises. W. R. A.

Response of photographic materials to atomic particles. T. R. WILKINS (J. Appl. Physics, 1940, **11**, 35—45).—The effects of α-particles, protons, and deuterons on photographic emulsions and the applications of these effects are described and discussed. J. W. S.

Thermal diffusion separation of radioactive and ordinary hydrogen isotopes. G. T. SEABORG, A. C. WAHL, and J. W. KENNEDY (J. Chem. Physics, 1940, **8**, 639—640).—Using a Clusius–Dickel column the isotopic separation of D and H from $^3H^*$ and D_2 has been investigated with respect to mol. fraction and temp. The separation factor is independent of mol. fraction, and increases with rising temp. The effect of using columns in series is also discussed. W. R. A.

Para–ortho composition of hydrogen gas produced from hydrogen atoms. II. N. SASAKI and O. MABUCHI (Proc. Imp. Acad. Tokyo, 1940, **16**, 223—224; cf. A., 1936, 573).—H_2 formed in the reaction $H + HI = H_2 + I$ at $-120°$ has the normal ortho–para composition. D. F. R.

Examination and standardisation of magnesium trisilicate. H. SURFLEET and G. V. PORTER (Quart. J. Pharm., 1940, **13**, 109—121).—*X*-Ray examination of preps. is recommended; the diagram of a true, synthetic Mg trisilicate is identical with that of naturally occurring sepiolite. Methods for determining the $MgO : SiO_2$ ratio (correct vals. for which are 1 : 2·21—2·28) are described. Genuine samples of Mg trisilicate have an antacid val. of 300 ml. of 0·05N-HCl (with a lag val. of ~50%) and an adsorption val. of $\nless$240 mg. of methylene-blue per g. (ignited wt.). F. O. H.

Sulphites of aluminium and iron at 30°. W. F. BARTZ (J. Amer. Chem. Soc., 1940, **62**, 2240—2241).—Equal wts. of dry $Al(OH)_3$ and H_2O were agitated at 30°. Measured amounts of SO_2 were injected and the pressures measured up to 300 mm. At 300 mm. SO_2 was withdrawn in measured amounts and the pressures measured. One basic Al sulphite is formed, $Al_2O_3,2SO_2,6H_2O$, colourless, stable in dry air, stable at <105° but decomp. at 105°, slowly sol. in H_2O. If air is not rigorously excluded SO_2 is oxidised. By similar methods $FeO,SO_2,6H_2O$ was prepared; it is stable in dry air, readily oxidised, and decomposes in moist air. W. R. A.

Indium. I. Indium oxalate and oxalatoindates. T. MOELLER (J. Amer. Chem. Soc., 1940, **62**, 2444—2446).—$H_2C_2O_4$ ppts. $In_2(C_2O_4)_3,10H_2O$ (I) from hot aq. $In_2(SO_4)_3$. When aq. $M_2C_2O_4$ solutions ($M = Na, K, NH_4$) are used the *dioxalatoindates* $NaIn(C_2O_4)_2,3H_2O$, $KIn(C_2O_4)_2,4H_2O$, and $NH_4In(C_2O_4)_2,2H_2O$ are pptd. The dioxalatoindate ion is assumed to be $[In(C_2O_4)_2(HO)_2]'$, capable of existing as *cis*- and *trans*-isomerides with the *cis*-form theoretically resolvable into two enantiomorphs. It is suggested that (I) may also be a dioxalatoindate $In[In(C_2O_4)_2(H_2O)_2]_3,14H_2O$, which on drying gives $In[In(C_2O_4)_2(H_2O)_2]_3,2H_2O$. Attempts to prepare K trioxalatoindate gave only an indefinite material of approx. composition $K_2C_2O_4,2K_3[In(C_2O_4)_3],7H_2O$. W. R. A.

Reduction of nitrosylsulphuric acid by sulphur monoxide. C. J. WILKINS (J.C.S., 1940, 1157—1159).—The liberation of N_2 in this reaction is not due to reduction of NO or to the intermediate formation of N_2H_4 or NH_2OH. NO_2 is not irreversibly reduced by SO. $Na_2S_2O_3$ and $Na_2S_4O_6$ do not reduce $NO·SO_2·OH$ below NO. H_2S and $Na_2S_2O_4$ only slightly reduce $NO·SO_2·OH$, traces of NH_3 being formed. C. R. H.

Fluorination of thiophosphoryl trichloride. Thiophosphoryl chlorofluorides. H. S. BOOTH and (MISS) M. C. CASSIDY (J. Amer. Chem. Soc., 1940, **62**, 2369—2372).—Stepwise fluorination of $PSCl_3$ by SbF_3 in presence of $SbCl_5$ (cf. A., 1939, I, 622) yielded $PSCl_2F$, b.p. 64·7±0·5°, $PSClF_2$, b.p. 6·3±0·5°, and PSF_3, b.p. −52·3±0·05, all colourless and readily hydrolysed in moist air. Solid $PSCl_3$ exists in two forms, α, m.p. −40·8°, β, m.p. −36·2°, and the α-form changes to the β-form on warming. $PSClF_2$ in certain concns. in air is spontaneously explosive. W. R. A.

Physicochemical properties of ammonium sulphophosphate, $(NH_4)_2H_3SO_4PO_4$. S. UNO (J. Soc. Chim. Ind. Japan, 1940, **43**, 197B).—NH_4 *sulphophosphate*, prepared from $(NH_4)_2SO_4$ and H_3PO_4, forms colourless monoclinic crystals, *d* 1·780. Empirical formulæ are given for the v.p. of saturated solutions at 15—40°, and for the solubility in H_2O at 0—100°. (Cf. A., 1940, I, 413.) F. L. U.

Sodium chlorite. Properties and reactions.—See B., 1940, 735.

Friction as an indicator in titration. R. E. D. CLARK (J.S.C.I., 1940, **59**, 216—217).—Alkalis (using at least one protein surface) in acid–alkali titrations and soap or Na alginate in determinations of the hardness of water show their presence when in excess by a sudden increase in the lubricating properties of the solution. By means of a simple apparatus employing a synchronous motor and a rotating wheel, around which a piece of thread is passed, end-points in these titrations are rendered directly visible by the movement of a pointer.

Fischer volumetric determination of water.—See B., 1940, 744.

Determination of total water-soluble chlorides in petroleum.—See B., 1940, 718.

Fluorescence analysis. IV. α-Naphthaflavone as a fluorescence indicator in iodometry and bromometry. H. GOTÔ (Sci. Rep. Tôhoku, 1940, **29**, 1—8; cf. A., 1940, I, 370).—The appearance, on removal of free I or Br, of a blue, ultra-violet-excited fluorescence of α-naphthaflavone can be used to determine the end-point of titrations with I or Br. Performance is satisfactory for $I–Na_2S_2O_3$ and $As_2O_3–KBrO_3$ titrations in presence of coloured ions, *e.g.*, Cr^{+++}. The effect of the addition of protective colloid has been studied. O. D. S.

Influence of protective colloids on the transition point of adsorption indicators. I. Iodides.

and chlorides. A. SANTOS RUIZ and R. PORTILLO (Anal. Fís. Quím., 1940, **36**, 91—94; cf. Fajans and Hassel, A., 1924, ii, 60).—The nature of the colour change and the titre at which it occurs are recorded when 0·1N-KCl or -KI is titrated with 0·1N-$AgNO_3$ in presence of 0·5% uranin or eosin together with 0·5% albumin, sol. starch, agar, fish glue, gum arabic, grenetin, dextrin, casein, Na oleate, saponin, gum tragacanth, carragheen, Na protalbate, or tannin. F. R. G.

Determination of fluorides in natural waters. R. L. FORD (J. S. African Chem. Inst., 1940, **23**, 47—51).—Direct titration with $Th(NO_3)_4$ (Zr–alizarin-S indicator) in the manner described gives results of sufficient accuracy with most types of natural waters. The Willard–Winter distillation method is unnecessarily long and complicated for routine determinations. L. S. T.

Analysis of oxygen-rich gas mixtures by Haldane's method. H. BECKER-FREYSENG and H. G. CLAMANN (Klin. Woch., 1939, **18**, 1274—1275).—A modification of Haldane's apparatus permits the analysis of gas mixtures of very high O_2 and CO_2 contents. M. K.

Voltammetric determination of oxygen. I. M. KOLTHOFF and H. A. LAITINEN (Science, 1940, **92**, 152—154).—Current–voltage curves obtained at 25·00° with a Pt-wire micro-electrode in various air-saturated buffer solutions (p_H 3—12) show that the diffusion current $\propto$ [O_2], but changes ~4% per degree with temp. The diffusion coeff. calc. for O_2 is 2·38 × 10^{-5} sq. cm. per sec. at 25°. Substitution of a rotating electrode for the stationary wire eliminates the interval before a steady current is reached, and increases the magnitude of the measured currents. Hence it can be used for determining traces of O_2. The diffusion current is a function of the time of bubbling N_2 through the solution. The O_2 content of unpurified tank N_2 is 0·15%, and that of N_2 purified over heated Cu, 0·02%. No trace of O_2 could be detected 10 min. after 0·1 g. of Na_2SO_3 was added to 100 ml. of 0·1N-KCl. L. S. T.

Determination of total sulphur in coal and coke.—See B., 1940, 717.

Determination of nitrates in waters and sewage.—See B., 1940, 766.

Analysis of mixtures of helium, oxygen, and nitrogen by determining velocity of sound. W. B. DUBLIN, W. M. BOOTHBY, H. O. BROWN, and M. M. D. WILLIAMS (Proc. Staff Mayo Clin., 1940, **15**, 412—416; cf. A., 1940, I, 134). H. H. K.

Potentiometric analysis of galvanic silver baths.—See B., 1940, 742.

Electrolytic determination of zinc by use of a buffer solution. S. YATAGAWA (J. Soc. Chem. Ind. Japan, 1940, **43**, 173B).—1·25 g. of borax and 6 g. of HCO_2Na are added to a solution containing ≯1 g. of Zn as $ZnSO_4$. An amount of HCO_2H (90%) which is 0·7 c.c. > that necessary to redissolve the ppt. is added. The solution is diluted to 160 c.c. (p_H 4·3) and electrolysed for 6 hr. at room temp. with a Cu-plated cylindrical Pt cathode and a spiral Pt anode. A current of 0·2 amp. is used. Rotation of the anode is unnecessary. C. R. H.

Rapid determination of the metal content of cadmium[-plating] baths.—See B., 1940, 742.

Volumetric determination of lead in screw-brass and similar alloys.—See B., 1940, 741.

Manometric micro-determination of copper.—See A., 1940, III, 779.

Qualitative semimicro-analysis with reference to Noyes and Bray's system. Tantalum and tungsten groups. (MISS) C. C. MILLER and A. J. LOWE (J.C.S., 1940, 1258—1263).—A modified Noyes and Bray method for separating the Ta and W groups is used in an analytical scheme for the separation of the members of each group. In this modified method the elements, as sulphates, are boiled with 7N-NaOH. The insol. portion consists of Ta, Nb, Zr, Ti, Bi, and Sb (part) as oxides or hydroxides, elementary Te (part), and traces of Sn. The sol. portion contains Na_2WO_4, Na_2MoO_4, Na_2TeO_3, Na_2VO_3, and Na_3PO_4, and complex salts of Sb (part), Sn, Pb, and small proportions of Nb and Ta. The two groups are further separated by well-known modern methods, the Ta-group separation being based on Schoeller's method. The scheme is applicable to mixtures containing ≯50 mg. of the combined metals and containing 0·25—50 mg. of Sb, Sn, and PO_4''', 0·25—10 mg. of Mo, Te, Ti, W, and Zr, 0·5—10 mg. of Ta and Nb, and minor amounts of V (0·25—2 mg.) and Bi (0·25—0·5 mg.). C. R. H.

Qualitative semimicro-analysis with reference to Noyes and Bray's system. Gold group. (MISS) C. C. MILLER and A. J. LOWE (J.C.S., 1940, 1263—1266).—The separation of the Au group incorporates Noyes and Bray's method for the initial separation of Au and Hg and Gilchrist and Wicher's method (cf. A., 1936, 180) for the separation of Pt from Pd, Rh, and Ir. Further separation is continued by means of various modern reagents. The scheme is applicable to mixtures containing ≯50 mg. of the combined metals and containing 0·25—50 mg. of Hg, 0·25—10 mg. of Au, Pd, and Pt, and 0·25—2 mg. of Ir and Rh. C. R. H.

Heats of organic reactions. IX. New calorimeter and the denaturation of methæmoglobin by alkali. J. B. CONN, G. B. KISTIAKOWSKY, and R. M. ROBERTS (J. Amer. Chem. Soc., 1940, **62**, 1895—1905).—Using a calorimeter suitable for studying liquid-phase reactions, the irreversible denaturation of methæmoglobin (I) in aq. KOH (p_H ~9—12) has been investigated at 25°. Denaturation of (I) at p_H 10—12 is measurably fast; heat is initially absorbed but towards the end of the reaction heat is evolved. The speed of the reaction increases as p_H is increased. The precipitability of (I) at the isoelectric point does not accurately measure the amount of denaturation. The process of denaturation is very complex. At const. p_H the heat of denaturation (ΔH) of (I) is ~100 kg.-cal. and with a const. quantity of KOH in solution ΔH is 138±14 kg.-cal. per mol. W. R. A.

Magnetic cooling: production and measurement of temperatures below 1° K. C. F.

SQUIRE (J. Appl. Physics, 1940, **11**, 232—240).—Experimental and theoretical research on the production and measurement of low temp. by introducing paramagnetic substances into a strong magnetic field is reviewed and discussed. J. W. S.

Constant-temperature control apparatus, utilising a special type of voltage regulator. J. S. BLAIR (J. Sci. Instr., 1940, **17**, 203—208).—Two circuits for regulating the energy input from fluctuating voltage mains to furnaces etc. are described. The input voltage is varied between two controlled limits, the voltage being automatically maintained at the lower voltage for a longer (or shorter) time than at the higher voltage when the mains voltage rises (or falls). With this control the fluctuations in a furnace at 1000° should not be > external temp. changes. C. R. H.

High-sensitivity radiation pyrometer. N. E. DOBBINS, K. W. GEE, and W. J. REES (Trans. Ceram. Soc., 1940, **39**, 253—257).—The instrument consists of a lens system which throws an image of the hot object on a photo-electric cell device, and has a sensitivity of 0·5—1° at 2000°. The instrument was used to obtain heating curves for Cr_2O_3 and Cr_2O_3–SiO_2 mixtures up to 2000°. J. A. S.

Sources of error in determination of double refraction. P. ALOISI (Period. Min., 1936, **7**, 249—255; Chem. Zentr., 1937, i, 4668).—Errors arise from variation in the thickness or hardness of the specimen, defects in the micrometer screw or objective, inaccurate focussing, or incorrect *n* vals. for the mineral and immersion medium. A. J. E. W.

Barrier-layer [photo-]cells in microphotometry. A. E. SANDSTRÖM (Ark. Mat. Astron. Fys., 1936, **B**, **25**, No. 18, 1—4; Chem. Zentr., 1937, i, 4536).—Accurate proportionality between measured intensity and incident light flux has been confirmed by test measurements. The results are reproducible, even after continuous illumination of the cell for 12 hr. The cell current should be $\nless$0·01 μa. A. J. E. W.

High-dispersion spectrograph for the ultraviolet. A. IONESCU (Rev. Opt. théor. instr., 1936, **15**, 298—304; Chem. Zentr., 1937, i, 4267).—The auto-collimating quartz-prism spectrograph described covers the λ range 2000—7000 A. with 12 24-cm. spectrograms. The dispersion is 0·52—2·6 A. per mm. at 2100—3680 A. A. J. E. W.

Focal isolation monochromator for the Schumann region. A. B. F. DUNCAN (Rev. Sci. Instr., 1940, **11**, 260—261).—A fluorite vac. monochromator for the region 1300—1900 A. is described. Lines in the N_2 arc spectrum were isolated in 85% purity, with intensity of the 1742–1745 A. doublet $\sim$1 × 10^{13} quanta per sec. O. D. S.

Photo-electric colorimeter–fluorimeter. D. K. FROMAN and W. D. MCFARLANE (Canad. J. Res., 1940, **18**, **B**, 240—245).—The colorimeter is of the compensating two-photo-cell type and may be used as a fluorimeter by changing the lamp and filters. D. F. R.

Electronic relay for heat control. A. C. HALL and L. J. HEIDT (Science, 1940, **92**, 133—134).—The circuit described controls the bath temp. to 0·02°, and requires a 115-v. a.c. or d.c. power source. L. S. T.

Small-scale electrodialysis cell. H. B. COLLIER (Canad. J. Res., 1940, **18**, **B**, 252—254).—The solution is enclosed by two concentric Cellophane sacs, 18 and 27 mm. diameter, separating the anode (25 × 50-mm. Pt foil) and cathode (Hg) compartments through which H_2O is circulated. Rapid dialysis may be effected, 98% of a 2·3M-$(NH_4)_2SO_4$ solution being removed after 3 hr. at 50 ma. D. F. R.

Apparatus for detecting pyro-electric effect in crystals. R. G. WOOD and C. H. MCCALE (J. Sci. Instr., 1940, **17**, 225—226).—The crystal is held in any desired orientation by two flat springs, one being earthed and the other connected to a quadrant electrometer. The leads from the springs are supported and insulated by a S plug in an earthed brass tube. Deflexions obtained with picryl-*p*-toluidine and *s*-$C_6H_3Ph_3$ are given. D. F. R.

Electrodes for potentiometric and conductometric titrations. H. GOTÔ (Sci. Rep. Tôhoku, 1940, **29**, 9—21).—Convenient electrodes for potentiometric titrations were constructed from a Pt wire dipping into electrolyte solution contained in a glass micro-filter tube, a glass tube with sintered end, a tube with a ground-glass plug, or a tube with a glass stopcock. Platinised and Au-plated glass electrodes are convenient for conductometric titrations in solutions containing org. solvents. O. D. S.

Ionisation gauge circuit. R. M. BOWIE (Rev. Sci. Instr., 1940, **11**, 265—267).—A circuit suitable for industrial use with the gauge of Morse and Bowie (A., 1940, I, 235) is described. O. D. S.

Interval meter and its application to studies of Geiger counter statistics. R. I. DRISCOLL, M. W. HODGE, and A. RUARK (Rev. Sci. Instr., 1940, **11**, 241—250).—An instrument, by means of which the no. of intervals between discharges in a Geiger counter which are > any given time can be measured and compared with the total count, is described. For two A-filled counters excited by γ-rays at counting rates from 0·9 to 3·0 counts per sec. the instrument gave results agreeing with statistical theory. Significant deviations from theory were observed for a H_2-filled counter excited with γ-rays or light at rates from 1·9 to 4·5 counts per sec. O. D. S.

Grid to reduce operating voltage in Geiger–Mueller counters. S. A. KORFF and W. E. RAMSEY (Rev. Sci. Instr., 1940, **11**, 267—269). O. D. S.

Micro-analysis of gases. R. SPENCE (J.C.S., 1940, 1300—1303).—A new apparatus for the const.-vol. micro-analysis of gases consists essentially of a loop of capillary tubing in which an absorbent removes a constituent of the gas. The loop is fitted with non-return valves which enable the gas to be circulated over the absorbent. After withdrawing the gas into a micro-burette and measuring the pressure change, the gas can be returned, if necessary, to a second loop containing a different absorbent. C. R. H.

Microchemical kits. R. D. COOL (J. Chem. Educ., 1940, **17**, 283—286).—Portable arrangements for reagents are described. L. S. T.

Portable laboratory for the microscopist. G. WEINGARTEN (J. Chem. Educ., 1940, **17**, 293—295).—A portable arrangement of apparatus for performing qual. micro-analysis is described. L. S. T.

Packed fractionating columns and the concentration of isotopes. K. COHEN (J. Chem. Physics, 1940, **8**, 588—597).—Theoretical. The behaviour of isothermal packed fractionating columns is deduced from their differential equation. The rate of approach to equilibrium and the relation between rates of production and fractionation are studied with reference to the separation of isotopes. W. R. A.

Small-scale production of liquid nitrogen. C. T. LANE and W. W. WATSON (Rev. Sci. Instr., 1940, **11**, 272).—Apparatus is described for the prep. of liquid N_2 by condensation at 40 lb. pressure using liquid-air cooling. O. D. S.

Micro-Kjeldahl apparatus. H. HOCH (Biochem. J., 1940, **34**, 1209—1210).—With the apparatus described 50—150 μg. of N can be determined with an accuracy of $\pm 3\%$. P. G. M.

Apparatus for coating surfaces with magnesium oxide. K. R. MAY (J. Sci. Instr., 1940, **17**, 231). D. F. R.

Separation of liquid mixtures by thermo-diffusion. H. KORSCHING and K. WIRTZ (Ber., 1940, **73**, [*B*], 249—269).—Mainly a detailed account of work reported previously (A., 1939, I, 282, 483; 1940, I, 35; Clusius and Dickel, A., 1939, I, 224). The theory of the thermo-diffusion effect in liquids (cf. A., 1939, I, 470; Debye, A., 1940, I, 135) is reviewed and discussed. Three types of apparatus are described, in each of which the length of the diffusion path is 10 cm. Two are of metal; in one the heated and cooled surfaces are parallel flat plates, and the other consists of concentric sleeves, between which diffusion occurs in an annular space. The third, less efficient, model is of glass, and resembles a Liebig condenser with an additional, heated inner tube. Small reservoirs are provided at the top and bottom of the diffusion space. Methods of using the apparatus in stage-by-stage separations are suggested. The separation of various typical mixtures, which cannot be predicted *a priori*, is examined. The practical utility of the method is illustrated by a separation of nearly pure n-C_6H_{14} from petroleum distillates, and reduction of the H_2O content of EtOH from 4·4 to 0·2%, and of the thiophen content of C_6H_6 from 1·2 to ~0·015% (3, 1, and 4 stages, respectively). The applicability of the method to separations in solution is also demonstrated [with L. W. MASCH] by a partial separation of cholestatrienone dibromide from cholestenone in C_6H_6 solution. A. J. E. W.

Formation of protective films. L. H. CALLENDAR (Nature, 1940, **146**, 304; cf. A., 1940, I, 369). L. S. T.

Determination of distribution of crystallites in fibres by direct and indirect methods. Y. GO (Bull. Chem. Soc. Japan, 1940, **15**, 239—258).—A type of *X*-ray camera designed for direct determination of the distribution of crystallites in fibres by using reflexions from the meridian plane ("diatropic reflexions") is described. Formulæ used in determining the distribution indirectly are discussed and the results compared. F. J. G.

Samuel Guthrie. F. H. GETMAN (J. Chem. Educ., 1940, **17**, 253—259). L. S. T.

Geochemistry.

Physico-chemical analysis and the annual cycles of salt lakes. N. S. KURNAKOV, I. B. FEIGELSON, and A. G. BERGMAN (Ann. Sect. Anal. Phys.-Chim., 1940, **12**, 189—212).—The results of determinations at frequent intervals from 1932 to 1938 of the NaCl, $MgCl_2$, and $MgSO_4$ contents of L. Elton water are expressed by means of "cyclochronograms" (curves connecting concn. of a given salt with temp., date, and [NaCl]). (Cf. A., 1940, I, 413.) R. T.

Growth phenomena in diamond. H. W. LINDLEY (Fortschr. Min., 1937, **21**, 71—72; Chem. Zentr., 1937, i, 4759).—Microscopical examination of polished South-west African diamonds generally reveals distinct crystal zones (mimetic overgrowths), which are detected by changes of n and double refraction, and in some cases by differences in fluorescence. Six octahedral and eight tetrahedral zones have been observed in an apparently homogeneous crystal; the boundaries are shown to have developed during growth of the crystal. A. J. E. W.

Zircon. R. BRAUNS (Deut. Goldschmiede-Ztg., 1937, **40**, 63—64; Chem. Zentr., 1937, i, 4760).—Three types of colourless zircon are distinguished; they are initially (*a*) brown (jacinth), (*b*) rose-red (decolorised by heating at 500° and in sunlight, respectively), and (*c*) colourless. On exposure to radiation from Ra, in which all three types phosphoresce, (*a*) quickly regains its colour, whilst (*b*) first becomes rose-red and then assumes a jacinth shade; (*c*) is unaffected. Zircon contains traces of Th and meso-Th and dispersed colour centres (Fe, Mn). A. J. E. W.

Zircon. J. W. HOWARD (J. Chem. Educ., 1940, **17**, 265—267).—Sources, composition, properties, and uses of zircon are discussed. L. S. T.

Occurrence of barite in an iron ore deposit in Namaqualand. M. MATHIAS (Trans. Roy. Soc. S. Africa, 1940, **28**, 207—217).—The barite forms the principal gangue mineral of the magnetite deposit at "Zuurwater" farm, Namaqualand. A chemical analysis of the magnetite–barite rock is given, and its origin discussed. L. S. T.

Sillimanite-corundum rock: a metamorphosed bauxite in Namaqualand. C. B. COETZEE

(Trans. Roy. Soc. S. Africa, 1940, **28**, 199—205).—The paragenesis of the rock, which has SiO_2 26·01, TiO_2 5·55, Al_2O_3 66·30, Fe_2O_3 0·41, FeO 0·54, MnO 0·01, CaO none, MgO none, $K_2O + Na_2O$ 0·09, H_2O+ 1·00, H_2O- 0·08, total 99·99%, is described. It originated probably by the static metamorphism of a dominant aluminous sediment, probably a bauxite. L. S. T.

Development of the mineral deposit at Mawchi [Burma] as determined by its geology and genesis. G. V. HOBSON (Trans. Min. Geol. Met. Inst. India, 1940, **36**, 35—78).—General geology is described, and genesis of the ore-body is discussed in detail. The mineralisation of the granite, and the Sn–W ratio, are also discussed. L. S. T.

Sulaipat iron mine. F. G. PERCIVAL (Trans. Min. Geol. Met. Inst. India, 1940, **36**, 26—32).—Mainly descriptive. The ore is massive and dense with often >69% of Fe. The P content is low. Production data are recorded. L. S. T.

Isomorphous replacement and superlattice structures in the plagioclase felspars. S. H. CHAO and W. H. TAYLOR (Proc. Roy. Soc., 1940, **A**, **176**, 76—87).—*X*-Ray analysis shows that the albite structure extends from the pure soda-felspar to at least 22% lime-felspar, the unit cell being approx. 8 × 13 × 7 A., and containing 4 mols. of $NaAlSi_3O_8$ or the equiv. when (CaAl) replaces (NaSi). There is a similar range of isomorphism near pure lime-felspar, $CaAl_2Si_2O_8$, with the anorthite structure 8 × 13 × 14 A. The intermediate plagioclases seem to consist of alternating sheets of the albite and anorthite structures. G. D. P.

Hydromagnesite. M. FENOGLIO (Period. Min., 1936, **7**, 257—284; Chem. Zentr., 1937, i, 4760; cf. A., 1937, I, 205).—A crystallographic, optical, and *X*-ray study of specimens from various sources indicates that hydromagnesite has rhombic-bipyramidal symmetry with a simple Γ-lattice, space-group D_{2h}^1. The formula $5MgO,4CO_2,5H_2O$ is confirmed. A. J. E. W.

Synthesis of alumopharmacosiderite; formula and structure of pharmacosiderite. G. HÄGELE and F. MACHATSCHKI (Fortschr. Min., 1937, **21**, 77—78; Chem. Zentr., 1937, i, 4760).—A paste prepared by addition of K_2HAsO_4 to conc. aq. $Al_2(SO_4)_3$ is heated at 250° in a sealed tube; *alumopharmacosiderite* (I) remains as isotropic cubes after treating the product with HCl on the H_2O-bath. The *X*-ray powder diagrams for (I) and pharmacosiderite, $Fe_3(AsO_4)_2(OH)_3,5H_2O$, are almost identical, with *a* 7·75, 7·94 A., respectively. The formula $Al_3(AsO_4)_2(OH)_3,5H_2O$ agrees with analyses of (I), but requires 1½ mols. in the unit cell; $Al_5As_3O_{12}(OH)_6,6H_2O$ gives one mol. per cell, space-group T_d^1. The continuous three-dimensional structure contains AsO_4 tetrahedra and $AlO_3(OH)_3$ octahedra, with $Al(H_2O)_6$ octahedra in some of the large lattice spaces. A. J. E. W.

Structural relations between sulphates and phosphates or arsenates, particularly between gypsum and pharmacolite. B. GOSSNER (Fortschr. Min., 1937, **21**, 34—36; Chem. Zentr., 1937, i, 4760).—The morphological axial ratios for gypsum (I) and pharmacolite ($CaHAsO_4,2H_2O$) (II) are $a:b:c = 0·6895:1:0·4132$ and $0·6236:1:0·3548$, with β 98° 58′ and 96° 36′, respectively. *X*-Ray measurements show that a comparison is possible if new axes are assigned to (II), such that $h' = -l$, $2k' = k$, $2l' = h$, $a':b':c' = 2c:b:\frac{2}{3}a =$ 0·7096 : 1 : 0·4157. (I) and (II) have *a* 10·47, 10·97; *b* 15·15, 15·40; *c* 6·28, 6·29 A. A structural similarity between hamlinite, alurcite, and bendantite is noted. A. J. E. W.

Geology, mineralisation, and placers of Tarryall and Beaver Creeks, Park Co., Colorado. Q. D. SINGEWALD (Econ. Geol., 1939, **34**, 132). L. S. T.

Structural relations of chromite deposits. E. SAMPSON (Econ. Geol., 1939, **34**, 130).—Five structural types of deposit are proposed, and localities in which these types occur are named. L. S. T.

Quicksilver deposits of the Terlingua region, Texas. C. P. ROSS (Econ. Geol., 1939, **34**, 125).—The region contains Cretaceous strata, largely calcareous, cut by many intrusions. Many of the lodes are near the base of the impervious Del Rio clay. The solutions penetrated only along open passageways. The Hg was introduced probably in alkali sulphide solutions containing free alkali, from which most of the other original constituents of the solutions had separated earlier. Pptn. resulted mainly by mixing with ground H_2O containing H_2CO_3. L. S. T.

Geology and development of the Polaris-Taku [British Columbia] mine. D. C. SHARPSTONE (Econ. Geol., 1939, **34**, 127—128).—As ores occur in a complex system of faulted veins within volcanic greenstone walls; >200 tons are mined daily. The mineralisation is Au, arsenopyrite (I), pyrite, and minor stibnite in quartz and carbonates. Au and (I) were deposited early, and are intimately associated. L. S. T.

Bravoite from Mill Close mine, Derbyshire. F. A. BANNISTER (Min. Mag., 1940, **25**, 609—614).—Nodular bravoite has the pyrite structure with unit-cell edge *a* 5·49 A., and analysis (M. H. HEY) gave Fe 29·30, Ni 16·69, Co trace, S 53·40; *d* 4·82. A granular mixture of bravoite and pyrite gave for the former *a* 5·57 A., suggesting a second type of bravoite containing about 28% Ni. These vals. lie between those for pyrite (*a* 5·49 A.) and for artificial NiS_2 (*a* 5·74 A.). L. J. S.

[Alkali-containing] earth. III. Water-soluble matter of alkaline earth distributed in Pinkiang province. K. KAWASE and S. ANZO (Rep. Inst. Sci. Res., Manchoukuo, 1940, **4**, 119—139).—Analyses of the H_2O-sol. matter in soil from the alkali regions of Pinkiang indicate that the surface soil contains the largest quantities of total sol. matter, and that the relative concns. of anions follow the order $HCO_3' > SO_4'' > Cl' > CO_3''$. J. W. S.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

DECEMBER, 1940.

Transition probabilities in the doubly-excited helium atom. J. KREISLER (Acta phys. polon., 1935, **4**, 151—161; Chem. Zentr., 1937, i, 4902—4903).—Of the possible transitions, those involving no radiation are most probable. $2s3s^3S$—$1s2p^3S$ and $2s3s^3S$—$1s3p^3P$ transitions, corresponding with lines in the far ultra-violet, possess moderate probabilities. $2s3s^3S$—$2s2p^3P$ transitions, which give near ultra-violet lines possibly related to the coronium lines, are very rare. There is little prospect of identification of doubly-excited He lines in the near ultra-violet or visible regions. A. J. E. W.

Summation rules in normal "forced" dipole multiplets. B. MILIANCZUK (Acta phys. polon., 1935, **4**, 65—71; Chem. Zentr., 1937, i, 4904).—Sambursky's conclusion (A., 1928, 450) that the summation rule does not apply to forced multiplets is confirmed, although his intensity measurements on the 2^2P–4^2F doublet of Cu I show deviations from theory. Ornstein and Burger's measurements (A., 1931, 664) correspond with a special case in which the rules apply. A. J. E. W.

Description and analysis of the second spectrum of vanadium (V II). W. F. MEGGERS and (MISS) C. E. MOORE (J. Res. Nat. Bur. Stand., 1940, **25**, 83—132).—λ and intensity measurements are recorded for 1700 lines of the V II spectrum in the λ range 1314—7015 A. 89 identified terms, including 31 singlets, 41 triplets, and 17 quintets, account for 86% of the lines. The electronic configurations responsible for most of the terms are identified, but further study of the spectrum is necessary for the determination of the ionisation potential of V^+. J. W. S.

Arc spectrum of cobalt. H. N. RUSSELL, R. B. KING, and C. E. MOORE (Physical Rev., 1940, [ii], **58**, 407—436).—Tables are given of terms, electron configurations, full data for 3007 lines, of which 2725 are classified, identities of 768 multiplets of the doublet, quartet, and sextet systems, and Zeeman data for 871 lines. g vals. were derived for 270 levels, mostly having nearly the theoretical vals. for LS coupling. There are some cases of g sharing. The principal ionisation potential is 7·84 v. Results accord with Hund's theory and with available data (cf. Catalan, A., 1936, 769, 916). The new λ data include 1282 lines measured interferometrically, and also 274 lines at λλ 2230—1814. N. M. B.

Possibility of spectrographic detection of solar radiation in the region 2000—2200 A. E. VASSY (Rev. Opt. theor. instr., 1936, **15**, 81—93; Chem. Zentr., 1937, i, 4901).—The absorption of solar ultra-violet radiation at different heights (h) in the atm. is discussed. Extrapolation of experimental data indicates that light in this λ range should be detected at $h = 25$ km. A. J. E. W.

Spectrum of *BD* + 30° 3639. P. SWINGS and O. STRUVE (Proc. Nat. Acad. Sci., 1940, **26**, 548—553).—Data are recorded for the emission lines of the Wolf–Rayet nucleus of *BD* + 30° 3639 at 3332—4786 A. The nucleus is a typical C star, with no trace of N at any stage of ionisation. There is no systematic red shift. Measurements of the narrow bands of the planetary nuclei *NGC* 6543 and HD 167362 show N IV and C IV in the first case, whilst the second is a pure C star. Neither has appreciable systematic red shift. A decrease in width of bright lines of various elements with increasing ionisation potential is found. The ejection velocities for He I and C III are 488 and 378 km. per sec., respectively. L. J. J.

Radio-frequency spectra of sodium, rubidium, and cæsium. S. MILLMAN and P. KUSCH (Physical Rev., 1940, [ii], **58**, 438—445; cf. A., 1940, I, 275).—The hyperfine structures of the ground states of ^{23}Na, ^{85}Rb, ^{87}Rb, and ^{133}Cs were measured by observing radio-frequency spectra under optimum precision conditions. Separations found in cm.$^{-1}$, and in abs. frequency units, sec.$^{-1}$ × 10^{-6} (in parentheses), are: ^{23}Na, 0·059103 (1771·75); ^{85}Rb, 0·10127 (3035·7); ^{87}Rb, 0·22797 (6834·1); ^{133}Cs, 0·30661 (9191·4). N. M. B.

***X*-Ray $K\beta_{2,5}$-emission lines and *K*-absorption limits of copper–zinc alloys.** J. A. BEARDEN and H. FRIEDMAN (Physical Rev., 1940, [ii], **58**, 387—395; cf. A., 1939, I, 589).—Investigations on line shapes and edges, using a double-crystal spectrometer, show that mixing Cu with Zn increases the high-energy part of the emission of Cu $K\beta_{2,5}$ and decreases the corresponding part of the intensity of Zn $K\beta_2$. The magnitude of this redistribution of high-energy conduction electrons between Cu and Zn agrees with calculations, which predict a max. positive charge of ~10% of an electronic charge on a Zn atom dissolved in a Cu lattice. Results support the interpretation of Cu $K\beta_{2,5}$ structure which attributes the extra low-frequency emission to $3d$ band emission. In every alloy Zn $K\beta_5$ appears with very little change in width or intensity per Zn atom, and is due to $3d$ quadrupole emission. There is no evidence of any effect of crystal structure on the emission lines. N. M. B.

***K*-Absorption edges and $K\beta_{2,5}$-emission lines of two zinc–nickel alloys.** J. A. BEARDEN and W. W. BEEMAN (Physical Rev., 1940, [ii], **58**, 396—

399; cf. preceding abstract).—Measurements of line shapes and edges of Zn and Ni in two alloys containing 17 and 30 wt.-% Zn, respectively, are reported. The lines arise from transitions of valency and $3d$ electrons into the empty K shell. In the two alloys the Zn emission line and absorption edge are shifted ~1 v. towards lower energies and the line is narrowed. Ni is changed only slightly. Results indicate that the higher-energy valency electrons of Zn are shared with Ni and probably go into $3d$ states about the Ni atoms (cf. Wheeler, A., 1940, I, 66).

N. M. B.

Copper and nickel X-ray $K\beta_{2,5}$-emission lines and K-absorption limits in copper-nickel alloys. H. Friedman and W. W. Beeman (Physical Rev., 1940, [ii], **58**, 400—406).—The shapes of the Cu $K\beta_{2,5}$ and Ni $K\beta_5$ lines from Cu–Ni alloys vary smoothly with composition, tending, with increasing % of the emitting atoms, to a flattening out of the peaks, explained as due to a loss of $3d$-band dipole radiation with increasing dilution of the emitting atom. The absorption limits are unchanged by the alloying.

N. M. B.

Principal M-series emission lines of tungsten and the K absorption of magnesium and aluminium. J. H. Munier, J. A. Bearden, and C. H. Shaw (Physical Rev., 1940, [ii], **58**, 537—543).—Using a double-crystal X-ray spectrometer, with technique extended to long X-ray λλ by thorough evacuation of the spectrograph and a windowless X-ray tube, measurements of widths and relative intensities of the prominent M-series W lines are reported. Accompanying the diagram lines are ~33 satellite lines. Structure not previously resolved photographically is recorded for the K-absorption edges of Mg and Al. Qual. comparison of the intensity of the continuous radiation from W to that from Al at 10 A. indicates a ratio <1, whereas theory predicts ~6. N. M. B.

Secondary K-absorption spectra of sulphur. N. Bagchi (Indian J. Physics, 1940, **14**, 85—88).—K-Absorption photographs for orthorhombic S show secondary structures extending over a large energy (87 v.) range on the short-wave side of the primary, which comprise two regions. Some of the bands at a distance from the main edge are more intense than those adjoining it and no regularity in intensity of dark and light bands is evident. W. R. A.

Chemical constitution and K[-level] X-ray absorption spectra. XV. Preliminary work with a high-intensity spectrograph using a concave bent crystal. O. Stelling. **XVI. Chromium compounds.** O. Stelling and K. A. Wallén (Svensk Kem. Tidskr., 1940, **52**, 144—161, 161—169).—The construction, calibration, and operation of a high-intensity, high-dispersion (11·5 X per mm. at 2060 X) X-ray spectrograph, using a bent quartz (preferably) or calcite crystal (Johann's method; r = 500 mm.), are described. Earlier work on Cl (A., 1933, 214) and Cr (A., 1926, 987) has been corr. and extended. The K-level absorption spectra of $ZrCl_4$, $CeCl_4$, pyridine and quinoline hydrochlorides, and the corresponding complexes (e.g., $CeCl_4,2C_5H_5N,HCl$) have been measured. The twin bands of the metal chlorides and the single band of the org. hydrochlorides reappear in the complexes, but λ for the latter is increased (Ce) or decreased (Zr). Twin bands are given by all non-ionised chlorides, the band of longer λ being due to a transition from the K- to the (incomplete) M-level. The M-level of Cl′ is complete and the second band is therefore absent. An improved method for investigating the spectra of solutions (cf. A., 1934, 133, 352) is described. The fine structure of the K-absorption bands of NaCl and KCl persists in solution, at least at concns. >2N. (cf. A., 1931, 993). Measurements of L-level absorption bands have been made on a large no. of I compounds of all types. The L_I-level gives a complicated line spectrum independent of the state of combination of the I, but the L_{III}- and L_{II}-levels give simple characteristic bands for I_2, I′, IO_3', and IO_4'. Vals. obtained with org. I compounds were largely invalidated by decomp. The absorption band of Cr at 2065·1 X (the weak band at 2061·6 X is probably due to oxidation—Cr_2O_3 2061·4 X) is repeated at shorter λ in all Cr compounds (Cr_2S_3 2062·7 X, K_2CrO_4 2059·1 X). Cr^{VI} compounds give an additional strong band of higher λ (Ag_2CrO_4 2058·9 and 2064·6 X, $KCrO_3Cl$ 2059·5 and 2065·0 X); the spectra of K_2CrO_4 and $K_2Cr_2O_7$ are identical. The presence of a faint second band in the spectra of Cr_2S_3 and $CrCl_3,3C_5H_5N$ suggests that the single band of most Cr^{III} compounds is really an irresolvable twin. CrO_5,C_5H_5N gives a spectrum of Cr^{VI}, and $CrO_4,3NH_3$ one of Cr^{III} type. K_3CrO_8 gives a single band corresponding with the shorter-wave band of Cr^{VI} compounds. None of these compounds decomposed during irradiation. M. H. M. A.

Electrical breakdown of gases at high pressure. E. Finkelmann (Arch. Elektrotech., 1937, **31**, 282—286; Chem. Zentr., 1937, ii, 15).—Breakdown potential (X) measurements for N_2, CO_2, air, and H_2 have been made in homogeneous fields in gaps (b) of ≯2 cm., and between concentric cylinders (b ≯4 cm.), at pressures (p) ≯20 atm. Deviations from Paschen's law occur with both small and large b vals. Owing to a smaller fall in X at high p in the latter type of field, CO_2 is often preferable to N_2 for high-voltage insulation. A. J. E. W.

Transformation of light energy into free electron energy, similar to phosphorescence. R. Suhrmann (Festschr. Tech. Hochschule Breslau, 1910—1935, 457—460; Chem. Zentr., 1937, i, 4197—4198).—The photosensitivity (s) of a K cathode sensitised with at. H is max. for exciting light of λ 4300 A. At liquid air temp. s is reduced by irradiation with light of this λ, but the original val. is restored by warming to room temp. or by exposure to red light. Such treatment causes emission of the initial excitation energy in the form of free electrons.

A. J. E. W.

Period of photo-emission in a counter discharge. W. E. Ramsey (Physical Rev., 1940, [ii], **58**, 476—477; cf. A., 1940, I, 306).—Experiments (described) with two Geiger–Müller counters show that the photon emission in a counter takes place during a short time interval following the initiation of the discharge, and that few, if any, photons are

emitted during the greater part of the time required by the wire to reach its max. negative potential. Results accord with Montgomery's discharge mechanism (cf. *ibid.*). N. M. B.

Analysis of the angular distribution curve of elastically scattered electrons in a spherically symmetrical atomic field. S. WESTIN (Kong. Norske Vidensk. Selsk. Forh., 1936, **9**, 122—125; Chem. Zentr., 1937, i, 4898; cf. Z. Physik, 1933, **83**, 581—618).—Theoretical. A. J. E. W.

Complete isometric consistency chart for *e*, *m*, and *h*. J. W. M. DU MOND (Physical Rev., 1940, [ii], **58**, 457—466).—An amplification and extension of previous work (cf. A., 1939, I, 507). The dilemma arising from discrepancies between various measurements of functions of the consts. is exhibited. N. M. B.

***X*-Ray electrons expelled from metals by silver $K\alpha_1$ radiations.** C. J. B. CLEWS and H. R. ROBINSON (Proc. Roy. Soc., 1940, **A**, **176**, 28—33).—The energies of electrons expelled from targets of Au, Pt, Ag, and Cu were measured in the magnetic spectrograph. The results, combined with earlier measurements, yield a val. $1{\cdot}380_3 \times 10^{-17}$ for h/e, $6{\cdot}62_0 \times 10^{-27}$ erg sec. for h (taking e as $4{\cdot}8022 \times 10^{-10}$), and $1/137{\cdot}1_4$ for the fine-structure const. G. D. P.

Physical and astronomical information concerning particles of the order of magnitude of the wave-length of light. F. EHRENHAFT (J. Franklin Inst., 1940, **230**, 381—393).—Experiments described show that on small spheres charges $< e$ exist; light can exert a form of attracting as well as a repelling force on matter; an intense beam of light causes bodies to move in either direction of the lines of force of a homogeneous magnetic field as if they were single magnetic N. and S. poles (magnetophotophoresis). Astronomical implications are discussed. N. M. B.

Characteristics and function of anode spots in glow discharges. S. M. RUBENS and J. E. HENDERSON (Physical Rev., 1940, [ii], **58**, 446—457; cf. Thomas, A., 1930, 271).—In N_2 in the pressure range 0·15—1·50 mm., brilliant hemispherical anode spots appear on a small disc or spherical anode at the centre of a large Cu spherical discharge chamber acting as cathode, allowing large anode c.d. with a normal fall in potential. At a crit. anode c.d. the spots form and arrange themselves in geometrical patterns. Space potentials, electron temp., and electron and ion densities determined by a Langmuir probe analysis show that the spots are regions of intense ionisation and that the region above them contains a net positive space charge. The potential fall through a spot is nearly equal to the first ionisation potential of N. A method was developed for growing anode spots on a small disc probe, the current–voltage characteristics of which show peaks accounting for the stability and size of the spots. The spots occur mainly in the region in which the current increases with small changes in voltage. At higher c.d. the spots move about because of the magnetic field accompanying the discharge. The function of the spots is to furnish the positive ions necessary to maintain a stable discharge in the plasma from the anode to the negative glow and to aid in the collection of electrons at the anode. A mechanism of spot formation as a combined space-charge and bipolar-current phenomenon is proposed. N. M. B.

Occurrence of negative ions in glow discharge through oxygen and other gases. R. W. LUNT and A. H. GREGG (Trans. Faraday Soc., 1940, **36**, 1062—1072).—In cold-cathode glow discharges through O_2 at $\sim$0·5 mm. negative at. ions at a stationary concn. comparable with that of the electrons have been detected in the positive column but not in the negative glow or the Faraday dark space. F. L. U.

Equilibrium of ionisation in the lower atmosphere. J. J. NOLAN (Proc. Roy. Irish Acad., 1940, **46**, 77—90).—Theoretical. Since recombination of small ions in air will occur largely along the tracks of ion-producing particles, the rate of recombination will be better represented as $\propto n$, the no. of small ions, than, as in older theories, $\propto n^2$. This leads to the equation for ionic equilibrium $q = an + bnZ$ (where q is the no. of ion pairs produced per cm.^{3} per sec., Z the no. of nuclei, and a and b are consts., b depending on the ions present), which agrees with experimental data. Vals. of q and b are calc. for various places. O. D. S.

Statistics of space charges in "glide sparks," [sparks along dielectric surfaces]. I. Elementary processes leading to most probable [potential] distribution. J. MÜLLER-STROBEL (Arch. Elektrotech., 1937, **31**, 233—253; Chem. Zentr., 1937, ii, 15). A. J. E. W.

Origin of the *D* layer. S. DEB (Indian J. Physics, 1940, **14**, 89—92).—The *D* layer of the upper atm. is due to the accumulation of Fe and Si dust-like particles of meteoric origin at 55—60 km. and the collapse of this layer accounts for its spasmodic detection. It is considered to possess the properties of temp. inversion with its consequent over-stability. The occurrence of fluorescence and at. Na lines in the night-sky spectrum and certain radio fade-out effects are also attributed to the presence of the *D* layer. W. R. A.

Early morning variation of ionisation and true height of region *E* of the ionosphere. S. P. GHOSH (Indian J. Physics, 1940, **14**, 101—107).—Results of observations at Calcutta (22° 31′ N.) for the year 1937—1938 are given. W. R. A.

Nuclear spin of ^{13}C. D. R. INGLIS (Physical Rev., 1940, [ii], **58**, 577).—Support for the val. 1/2 (cf. Hay, A., 1940, I, 382) is given by the empirical rule that all known magnetic moments of odd nuclei lie between the limits given by the simple single-particle model. This agrees with the val. predicted by the Hartree model and the α-model on the basis of the Larmor–Thomas type of spin–orbit coupling, but disagrees with the val. 3/2 inferred from analysis of an incompletely resolved band spectrum (cf. Townes, *ibid.*, 87). N. M. B.

Isotopic weights of chlorine, argon, and iron by the doublet method. T. OKUDA, K. OGATA,

K. Aoki, and Y. Sugawara (Physical Rev., 1940, [ii], **58**, 578—579).—Using a Bainbridge–Jordan mass spectrograph for the measurement of doublets, the results obtained were: ^{35}Cl 34·97903±0·00038, ^{37}Cl 36·97786±0·00036, ^{40}A 39·97637±0·00057 and 39·97500±0·00062 (discrepancy unexplained), ^{56}Fe 55·9572±0·0012 (provisionally), packing fraction −7·7, compared with Dempster's val. −7·0±0·4 (cf. A., 1938, I, 111). N. M. B.

Fifth report of the Committee on atoms of the International Union of Chemistry. F. W. Aston, N. Bohr, O. Hahn, W. D. Harkins, F. Joliot, R. S. Mulliken, and M. L. Oliphant (J.C.S., 1940, 1416—1417).—The International Table of stable isotopes for 1940 is given. Corrections and additions to the 1939 table are made in respect of Li, C, Cr, Fe, Mo, Eu, Hf, and U. A. J. M.

Tables of gold, cerium, and silver isotopic disintegration series. S. Bull (Stereochem., 1938, **2**, 86—91).

Uranium–thorium–radium–lead disintegration series. S. Bull (Stereochem., 1938, **2**, 76—80).—Speculative.

Neutron capture by uranium 238. E. T. Booth, J. R. Dunning, A. V. Grosse, and A. O. Nier (Physical Rev., 1940, [ii], **58**, 475—476; cf. A., 1940, I, 278).—Investigations on $^{238}U_3O_8$ after irradiation with neutrons show that the decay period and the sp. activity of the neutron-induced β-activity are in good agreement with those obtained from the capture in ordinary U_3O_8 and establish that the 24-min. resonance capture in U is due to ^{238}U. N. M. B.

Capture cross-section for thermal energy neutrons. C. Lapointe and F. Rasetti (Physical Rev., 1940, [ii], **58**, 554—556).—From measurement, with a BF_3 ionisation chamber, of the decrease in density of the thermal neutrons in H_2O on addition of the absorbing element, and comparing with the effect of a B solution under the same conditions, cross-sections relative to the cross-section for B are given for N, F, Na, P, Cl, K, V, Mn, Co, As, Se, Br, Cd, I, and Ba. N. M. B.

Excited states in stable nuclei. (A) T. R. Wilkins. (B) J. Chadwick (Nature, 1940, **146**, 401).—(A) Concerning priority in the use of a camera connected with the cyclotron to study the scattering of high-energy particles.

(B) A reply. L. S. T.

Decay constant of ^3H. R. D. O'Neal and M. Goldhaber (Physical Rev., 1940, [ii], **58**, 574—575).—Since the decay const. λ of ^3H is too small to be determined conveniently from the decay curve, experiments are described whereby λ is found from the relation $\lambda = N'/N$, where N is a known no. of ^3H nuclei produced, and N' is the observed no. of these nuclei which decay per unit time. The val. found for λ is 7×10^{-10} sec. (±25%), and the half-life 31±8 years. N. M. B.

Distribution in angle of α-particles from lithium bombarded with protons. V. J. Young, A. Ellett, and G. J. Plain (Physical Rev., 1940, [ii], **58**, 498—500; cf. Neuert, A., 1940, I, 90).—The distribution from the reaction $^7Li + {}^1H \rightarrow 2{}^4He$ is found to be of the form $1 + A \cos^2 \theta$. The variation of A with bombarding energy is characterised by a rapid increase in the range 250—325 ke.v., presumably indicating resonance to a broad excited level of ^8Be. N. M. B.

Distribution in angle of the long-range α-particles from fluorine bombarded with protons. W. B. McLean, A. Ellett, and J. A. Jacobs (Physical Rev., 1940, [ii], **58**, 500—502; cf. preceding abstract).—The distribution from the reaction $^{19}F + {}^1H \rightarrow {}^{16}O + {}^4He$, determined at 330, 375, and 435 ke.v. bombarding energies, shows strong fore-and-aft asymmetry which varies only slightly with the bombarding voltage. The distribution is well represented by $1 + 0{\cdot}66 \cos \theta + 0{\cdot}25 \cos^2 \theta + 0{\cdot}41 \cos^3 \theta$. N. M. B.

Angular distribution in the reaction ^{19}F (p, α). E. Gerjuoy (Physical Rev., 1940, [ii], **58**, 503—505).—Mathematical. The experimental constancy of the distribution with energy (cf. preceding abstract) implies broad levels and const. penetrabilities, the latter agreeing with calculation. The experimental distributions can most simply be accounted for by assuming that the chief contributions are from three levels of total angular momentum $J = 0, 1, 2$. This leads to the experimental curves without arbitrary assumptions as to the vals. of the line breadths or detailed assumptions as to the nuclear coupling scheme. N. M. B.

Protons from $^{13}C + {}^2H$. W. E. Bennett, T. W. Bonner, E. Hudspeth, and B. E. Watt (Physical Rev., 1940, [ii], **58**, 478—479; cf. Pollard, A., 1940, I, 51).—C prepared from CH_4 in which ^{13}C had been conc. by thermal diffusion was bombarded with 1·22-Me.v. deuterons. A group of protons of 55 cm. range was found and is attributed to the reaction $^{13}C + {}^2H \rightarrow {}^{14}C + {}^1H + Q$ (where $Q = 5{\cdot}9$ Me.v., calc.). The excitation curve for the protons shows a max. yield at ~1500 ke.v., and indicates an excited state in the intermediate nucleus (^{15}N) at 17·55 Me.v. N. M. B.

Simultaneous emission of three particles from an excited nucleus. J. M. Cork and W. Middleton (Physical Rev., 1940, [ii], **58**, 474).—S or CS_2 bombarded by 24-Me.v. neutrons from Li gave 12·7- and 137-sec. activities; 13-Me.v. neutrons from Be gave only the 12·7-sec. activity. The strong positron emitter of 137 sec. half-life was identified chemically as ^{30}P produced from ^{32}S by an (n, $2nP$) reaction or an (n, $3n$) reaction followed by the emission of a positron, the first established case of the simultaneous emission of 3 heavy particles from a nucleus. The 12·7-sec. activity (an electron emitter) is due to a P isotope of mass >31. N. M. B.

Radioactivity produced by proton bombardment of bromine and iodine. E. C. Creutz, L. A. Delsasso, R. B. Sutton, M. G. White, and W. H. Barkas (Physical Rev., 1940, [ii], **58**, 481—486).—Br bombarded with 5—6-Me.v. protons emits electrons of half-life 13±2 and 55±2 sec., shown by a β-spectrograph to be conversion electrons from at least two γ-rays of energies 127 and 187 ke.v. Physical

and chemical tests indicate that the activity is from a Kr isotope. The long-period ^{79,81}Kr reported by Snell (cf. A., 1938, I, 8) has a half-life of $34{\cdot}5\pm1$ hr. and a positron upper limit of $\sim0{\cdot}4$ Me.v. I targets emit electrons of half-life 75 ± 1 sec., shown to be conversion electrons from at least two γ-rays of energies 125 and 175 ke.v., coming from a Xe isotope. Radiation consisting of electrons, X-rays, and probably γ-rays, of half-life 32 ± 2 days, is also found. N. M. B.

Concentration of radioactive bromine produced by γ-radiation. W. H. BARKAS, P. R. CARLSON, J. E. HENDERSON, and W. H. MOORE (Physical Rev., 1940, [ii], **58**, 577).—In view of the small β-ray activity obtained in the study of nuclear reactions of the (γ, n) type, the radioactive atoms produced in a large bulk of material were conc. to increase the activity. Br, as EtBr, in a spherical vessel was irradiated by high-energy γ-rays from the reaction ^{7}Li(p,γ) ^{8}Be from a source situated at the centre, and the active Br was separated as AgBr. The periods obtained were 6·4 min., 18 min., and 4·5 hr., with relative intensities 1 : 3 : 2 at saturation, due to ^{78}Br, ^{80}Br, and ^{80}Br, respectively, formed from ^{79}Br and ^{81}Br, in each case by the loss of a neutron. The sources thus prepared were $\not<10$ times as strong as those obtainable without concn. N. M. B.

Internally converted γ-rays from radioactive gold. J. L. LAWSON and J. M. CORK (Physical Rev., 1940, [ii], **58**, 580).—The electron spectrum of radioactive Au, chemically separated from Pt bombarded with 9·5-Me.v. deuterons, was obtained with the magnetic spectrometer. The 164-day activity is too weak for analysis; the 5·6-day activity is due to a partly converted γ-ray of energy 356 ± 4 ke.v., the responsible isotope being ^{196}Au or ^{197*}Au. The other four peaks can be resolved into K- and L-conversion electron groups corresponding with γ-ray energies of 331 ± 3 and 410 ± 4 ke.v., respectively, and half-life ~3 days. N. M. B.

Photographic registration of heavy particles emitted during bombardment. J. M. CORK and P. F. BARTUNEK (Physical Rev., 1940, [ii], **58**, 580—581).—A magnetic spectrograph is described for observing the particles emitted from a target during bombardment in the cyclotron, independent of the disturbing effects of the scattered primary particles and the neutron background. From preliminary results, Pt and Au show mainly only the scattered deuteron beam; in Al only protons of $\sim11{\cdot}0$ Me.v. are observed (cf. McMillan, A., 1935, 559); Pd shows scattered deuterons and low-energy protons with roughly continuous distribution; Cu shows scattered deuterons, a proton group of $\sim8{\cdot}5$ Me.v., and an unexplained line of ~47 cm. air equiv. N. M. B.

Production of actinium-C'' from lead. E. BRETSCHER and L. G. COOK (Nature, 1940, **146**, 430—431).—Ac-C'' is obtained by bombarding $Pb(NO_3)_2$ with fast neutrons. The half-life period of the active body separated chemically is 4·6 min. There is little evidence for the production of ^{206}Tl either in this bombardment or in the slow-neutron bombardment of Tl. L. S. T.

Half-value periods of electron-emitting nuclei. A. E. HAAS (Proc. Nat. Acad. Sci., 1940, **26**, 565—567; cf. A., 1940, I, 337).—Further periodicities are observed in the half-val. periods of unstable β-emitting nuclei, when the latter are arranged in series according to their "isotopic no." (no. of neutrons — no. of protons. L. J. J.

Photon production of mesotrons. W. M. POWELL (Physical Rev., 1940, [ii], **58**, 474).—Photographs of a large Wilson cloud chamber containing 5 horizontal Pb plates, each 1 cm. thick, show tracks giving evidence of the production of a pair of mesotrons by a photon. N. M. B.

Connexion between the meson decay and the β-decay. S. SAKATA (Physical Rev., 1940, [ii], **58**, 576).—Considerations are given leading to the removal of the discrepancy between the theoretical proper lifetime of the meson ($\sim10^{-8}$ sec.) and the experimental val. (~1—5×10^{-6} sec.). N. M. B.

Secondary peak in the Rossi curve for tin. W. F. G. SWANN and W. E. RAMSEY (Physical Rev., 1940, [ii], **58**, 477).—Coincidence curves obtained with an apparatus previously described (cf. A., 1940, I, 189) are given and discussed. N. M. B.

Solid angle subtended by the main and shadow cones of cosmic radiation. H. P. KOENIG (Physical Rev., 1940, [ii], **58**, 385—386).—Calc. vals. for a wide range of energy and latitude are given graphically. N. M. B.

Internal conversion of γ-radiation in the L shell. M. H. HEBB and E. NELSON (Physical Rev., 1940, [ii], **58**, 486—491).—Mathematical. Non-relativistic calculations for the K shell (cf. Dancoff, A., 1939, I, 177) are extended to the L shell. Conversion coeffs. for the K and L shells and curves showing the ratio of K to L conversion for different energies and at. nos. are given. A simple relativistic formula for the conversion of magnetic multipole radiation is found. N. M. B.

Electron states in a crystal lattice, particularly in diamond. F. HUND and B. MROWKA (Ber. Verh. sächs. Akad. Wiss. Leipzig, math.-phys. Kl., 1937, **87**, 185—206; Chem. Zentr., 1937, i, 4198; cf. A., 1936, 142).—The properties of energy bands of individual electrons can be deduced qualitatively from the periodicity and symmetry of a crystal lattice. In diamond such deductions, with the approximations of Bloch (cf. Hund, A., 1932, 321) and Brillouin and certain calculations by Slater's method, lead to a quant. scheme for the term structure. A. J. E. W.

Electron states in a crystal lattice. II. Energy bands in simple lattices. F. HUND and B. MROWKA (Ber. Verh. sächs. Akad. Wiss. Leipzig, math.-phys. Kl., 1937, **87**, 325—350; Chem. Zentr., 1937, i, 4198; cf. preceding abstract).—Electron terms in various types of lattice are calc. by Slater's method. Bloch and Brillouin approximations are also calc. for the wurtzite lattice. A. J. E. W.

Atom factor of mercury. T. DERENZINI (Nuovo Cim., 1936, **13**, 423—425; Chem. Zentr., 1937, i, 4064).—The atom factor is calc. for $\sin\theta/\lambda \not>1{\cdot}2\times10^{-8}$ cm.$^{-1}$, using Hartree's eigenfunctions (A., 1934,

1285); the vals. agree with those obtained by other methods. A. J. E. W.

Interaction energies in radiation theory. H. Hurwitz, jun. (Physical Rev., 1940, [ii], 58, 467—471; cf. Weisskopf, A., 1939, I, 507).—Mathematical. Radiation interaction energies are calc. for a photon and electron, a photon and scalar or vector mesotron, two electrons, and two scalar mesotrons. N. M. B.

Interpretation of resonances in nuclear reactions. G. Breit (Physical Rev., 1940, [ii], 58, 507—537; cf. A., 1936, 658).—Mathematical. N. M. B.

Theoretical maxima and minima in the anomalous scattering of α-particles. P. Seligmann (Physical Rev., 1940, [ii], 58, 492—498).—The work of Wenzel (cf. A., 1934, 1151) on max. is generalised for a finite no. of l vals. and extended to include min. Applications to analysis of experimental data are discussed. Treatment of existing data for α-particle scattering by C and O indicates that l vals. at least as large as 2 are effective in producing the anomalies in both cases, and this conclusion is verified for C by a phase-shift analysis. N. M. B.

Self-consistent fields and diamagnetic susceptibility for Mg III. W. J. Yost (Physical Rev., 1940, [ii], 58, 557—560).—Mathematical. Self-consistent fields are calc., equations solved numerically, and functions tabulated. The calc. diamagnetic susceptibility is $-3{\cdot}74 \times 10^{-6}$. N. M. B.

Theory of Compton effect. K. C. Kar (Indian J. Physics, 1940, 14, 117—122).—By a wave-statistical theory of the interaction between matter and radiation the Einstein–Dirac formula for the intensity of Compton scattering is derived by taking into account the energy and momentum of recoil of the scattering electron. W. R. A.

Simple laboratory method of producing continuous ultra-violet light. H. N. Yadav (Indian J. Physics, 1940, 14, 169—171).—A method of producing H_2 continuum from the visible to 2200 A. is described. W. R. A.

Structure of the 3, 0 band, λ 2569, of OD. M. G. Sastry (Current Sci., 1940, 9, 368).—This band of OD corresponds with the λ 2447 band of OH, $^2\Sigma^+ \rightarrow {}^2\Pi_{inv.}$. The rotational structure has been analysed and the six main P,Q,R branches identified. The consts. are $B_3' = 8{\cdot}13$, $B_0'' = 9{\cdot}94$ cm.$^{-1}$ (cf. A., 1940, I, 310, 343, 401). A. J. M.

Weakening of stellar radiation by "continuous" molecular absorption in later types of star. K. Wurm (Z. Astrophysik, 1937, 13, 179—185; Chem. Zentr., 1937, ii, 8).—Two discontinuities in the spectra of N-type stars are identified as convergence limits ($\Delta v = 0$ and 1) of the $^3\Pi$–$^3\Pi$ system of C_2. Absorption in the higher vibrational states leads to a general reduction of intensity in the blue and violet regions of the continuum, which extends towards the red as mol. (C_2 and CN) formation proceeds in the R and N types. A. J. E. W.

Survey of the ultra-violet solar radiation at Johannesburg. S. J. Richards (S. African J. Sci., 1939, 36, 132—149).—Cells for measuring direct sunlight and the ultra-violet light from all parts of the sky are described. Monthly means of the ultra-violet intensities for various solar altitudes are tabulated and discussed, and the effects of atm. O_3 on intensity are recorded. The distribution of scattered ultra-violet light over the sky has been determined. L. S. T.

Nuclear spin of ^{37}Cl. E. F. Shrader (Physical Rev., 1940, [ii], 58, 475; cf. Elliott, A., 1930, 977).—In order to obtain the alternating intensity ratio in the spectrum of $^{37}Cl^{37}Cl$, Cl enriched in ^{37}Cl was placed in a special absorption tube giving a path length of 5 m., with which the 11 ← 1, 12 ← 1, 13 ← 1 bands of the $0^+ \leftarrow {}^1\Sigma^+$ system of Cl_2 in the region 5100—5200 A. were obtained. The intensity ratio showed 43% ^{37}Cl in the sample. The complexity of the 11 ← 1 and 13 ← 1 bands prevented the identification of lines due to $^{37}Cl^{37}Cl$. The alternating intensity ratio of 24 available lines in the 12 ← 1 band for $^{37}Cl^{37}Cl$ was 1·28. The ratio of $^{35}Cl^{35}Cl$ for these three bands, from normal Cl_2, gave 1·30. These ratios most nearly correspond with a spin of 5/2. It is concluded that ^{35}Cl and ^{37}Cl have the same nuclear spin of 5/2. N. M. B.

Spectrum of titanium monoxide in the λ region 8000—12000 A. K. Wurm and H. J. Meister (Z. Astrophysik, 1937, 13, 199—204; Chem. Zentr., 1937, ii, 10).—The spectrum of a Ti arc in air has been obtained with a plane-grating spectrograph (dispersion 6—45 A. per mm.); several bands have also been photographed in dispersion 2·5 A. per mm. for rotational analysis. 50 bands, some of which have been observed in stellar spectra, are recorded; of these 15 belong to the known $^3\Sigma$–$^3\Pi$ system. The remainder, which are generally degraded to the red and include strong bands at 8440, 8860, 9725, 10,125, and 11,030 A., form a new Σ–Π system. The bands have a complex structure. A. J. E. W.

Effect of an activator on the absorption spectrum of zinc sulphide powders. C. J. Brasefield (Physical Rev., 1940, [ii], 58, 436—438; cf. Kroger, A., 1940, I, 96).—Measurements by the diffuse-reflexion method, in the region 3200—4800 A., of the absorption of ZnS powders, alone and with various concns. of Ag activator, show that the long-λ limit of the absorption band of pure ZnS was at 3800 A. and that this limit moved to longer λλ with increasing concn. of activator. There was no evidence of a secondary absorption peak characteristic of the activator. N. M. B.

Mutual influence of water and heavy water. I. R. Rao and Y. P. Rao (Indian J. Physics, 1940, 14, 135—142).—A detailed account of work already noted (A., 1940, I, 310). W. R. A.

Rotational Raman scattering in liquid oxygen. B. P. Saha (Indian J. Physics, 1940, 14, 123—128).—Using an arrangement whereby liquid O_2 was rendered moisture-free, the rotational Raman scattering has been investigated and shows no discrete levels. The rotational wing extends to ~140 cm.$^{-1}$ from the Rayleigh line in agreement with the rota-

tional Raman spectrum of gaseous O_2, and max. intensity is at ~50 cm.$^{-1}$ from the Rayleigh line. It is concluded that for a diat. mol. in the liquid state the rotational lines are broader than in the gaseous state. The formation of cybotactic groups is considered improbable. No evidence of appreciable concn. of O_4 has been found. W. R. A.

Complex band spectrum associated with an oxide of silicon. R. C. PANKHURST (Proc. Physical Soc., 1940, **52**, 707—709).—Data are reported for a complex band system in the region λλ 4646—3672 arising in a heavy-current discharge tube with a quartz constriction and possibly due to SiO_2. The spectrum was photographed under high dispersion and appears to be an extension of one reported by Cameron (cf. A., 1927, 184). N. M. B.

Absorption spectra of hydroxy-aldehydes, hydroxy-ketones, and their methyl ethers. R. A. MORTON and A. L. STUBBS (J.C.S., 1940, 1347—1359).—The ultra-violet absorption spectra of simple *o*-, *m*-, and *p*-hydroxy-aldehydes, hydroxy-ketones, and their Me ethers are described. They are discussed from the point of view that widely different absorption spectra can be classified by assuming that only a very limited no. of essentially similar electron processes occur, that changes in the "environment" of the simple chromophores result in discontinuous displacements of the absorption max., and that these displacements correspond in the main with simple "vibrational" quanta. The principal absorption max. of all the above compounds is benzenoid in origin, but is considerably displaced to longer λλ in most cases. The substitution of certain groups, themselves transparent to ultra-violet (*e.g.*, CN, CO_2H, OH, OMe, NH_2), in the C_6H_6 ring can considerably modify the absorptive process located in the ring, as shown by displacement of the benzenoid absorption max. In the case of di-substitution, the second group has less effect than the first. The location of processes giving rise to absorption bands in the spectra of hydroxy- and methoxy-aldehydes and -ketones is discussed. The effects of solvent and of H-bond formation on the spectra are also considered. Displacements of the absorption max. for unchelated compounds are > for chelated compounds, and are in the direction of longer λλ. Chelation through H, association, and intermol. H-bond formation all result in a displacement of the benzenoid absorption max. to longer λλ. The absorption spectrum of the vapour of salicylaldehyde was investigated. All the OH-compounds when dissolved in alkalis show displacement of the long-λ absorption band to longer λλ. A. J. M.

Near ultra-violet absorption spectrum of heavy benzene. H. SPONER (J. Chem. Physics, 1940, **8**, 705—710).—The band system of C_6D_6 at 2700—2300 A. represents a forbidden transition $^1A_{1g} \rightarrow {}^1B_{2u}$, made "allowed" by vibrations of type $\epsilon_g{}^+$. The wave-nos. and intensities of the bands are recorded and interpretations are given for most of them. J. W. S.

Fundamental frequencies of certain trihalomethanes. G. GLOCKLER and G. R. LEADER (J. Chem. Physics, 1940, **8**, 699—705).—Raman frequencies are recorded for $CHBr_2Cl$, $CHCl_2Br$, $CHCl_2F$, $CHClF_2$, $CHBr_2F$, and CHClBrF and are compared with those for other halogen derivatives of CH_4. J. W. S.

Infra-red absorptions of polyhydroxylic compounds. M. M. DAVIES (Trans. Faraday Soc., 1940, **36**, 1114—1120).—Data for $CCl_3{\cdot}CH(OH)_2$ (cf. A., 1940, I, 145), $CCl_3{\cdot}CO_2H$, diphenyl triketone hydrate, and saligenin are presented. The results for the last three are discussed in relation to their structures. F. L. U.

Infra-red spectrum of potassium cyanate solutions. D. WILLIAMS (J. Amer. Chem. Soc., 1940, **62**, 2442—2444).—With freshly-prepared aq. KCNO intense absorption bands are obtained at 4·6 and 11·5 μ. and a weak band at ~7·4 μ. After several days the intensity of the strong bands diminishes, the weak bands become more intense, and new bands appear at 3·5 and 5·9 μ. The bands at 4·6 and 11·5 μ. (ν = 2170 and 870 cm.$^{-1}$) correspond with observed Raman data and are attributed to vibrations of the linear CNO′ group. The other bands are tentatively explained as arising from $NH_4^{\cdot}$ and CO_3'' groups produced by the hydrolytic processes: $KCNO + 3H_2O = KHCO_3 + NH_4OH$, and $2KCNO + 4H_2O = K_2CO_3 + (NH_4)_2CO_3$. W. R. A.

Ultra-violet absorption [spectra] of chlorinated quinones and quinols. E. SCHJÅNBERG (Svensk Kem. Tidskr., 1940, **52**, 185—200).—The ultra-violet absorption spectra of benzoquinone (I), quinol (II), and their Cl-derivatives in H_2O and EtOH exhibit no fine structure. Increasing replacement of H by Cl in (II) increases λ and ε of the absorption max. (in H_2O and EtOH), there being little difference between isomerides. For the more acidic compounds ε is reduced at λ above the absorption max. in presence of $HClO_4$. With increasing chlorination of (I) the main max. (2430 A.) in EtOH is displaced towards longer λ with slight decrease of ε, the latent max. (2900 A.) is similarly displaced and becomes separate, and the weak max. (4380 A.) disappears. In H_2O the latent max., even of (I), is developed and the main max. increased in λ and decreased in ε. Aq. solutions of quinones decompose rapidly on storage even in the dark. The absorption spectrum of undissociated quinhydrone (III) has been calc. from the spectra of (I), (II), and (III) (actual in H_2O). It has max. at 2620 A. (log ε = 4·58) and 3875 A. (log ε = 2·56). M. H. M. A.

Absorption and fluorescence spectra of dihydro*iso*benzfurans and *iso*benzfurans.—See A., 1940, II, 353.

[Absorption spectra of] phthalocyanines etc.—See A., 1940, II, 359.

Active nitrogen. I. Brightness of the afterglow under varied conditions of concentration and temperature. II. Incandescence of metals in active nitrogen, and quantitative estimates of the energy liberated. (LORD) RAYLEIGH (Proc. Roy. Soc., 1940, **A**, **176**, 1—15, 16—27).—I. Photo-

metric investigation of the integrated light shows that 3·18 candle-sec. per c.c. of N_2 are emitted; the no. of quanta emitted is $\sim 1{\cdot}3 \times 10^{-3}$ of the no. of mols. present. The addition of unexcited N_2 to the glowing N increases the instantaneous emission. Measurement of the change of emission when glowing N is allowed to diffuse into unexcited N_2 confirms the bimol. nature of the reaction. The effect of compressing the glowing gas is to increase the brightness inversely as the cube of the vol. Expansion of the glowing gas to double its original vol. diminished the brightness only 7-fold instead of the expected 8-fold. The effect of temp. was examined; the brightness was found to vary as $T^{-0{\cdot}64}$.

II. Sheets of Au, Cu, Ag, and Pt can be made red-hot or even melted by exposure to active N produced in a low-pressure discharge. The effect is used to measure the energy of active N by drawing a known quantity of gas through the activating discharge and then over the metal. The energy liberated at the metallic surface is surprisingly large, amounting to $\sim$10 ev. for every mol. of N_2 that passed through the discharge. The difficulty of reconciling this result with existing theories of the nature of active N and of accounting for it by dissociation is discussed.

G. D. P.

New invisible radiation. L. Zehnder (Schweiz. Bau-Ztg., 1937, **109**, 184—185; Chem. Zentr., 1937, ii, 8).—Photographic detection of radiation from aq. NaCl in course of crystallisation, from metal dissolving in dil. H_2SO_4, and from fermenting must is claimed.

A. J. E. W.

Chemiluminescence or cold light investigations. L. D. Johnson (J. Chem. Educ., 1940, **17**, 295—296).—Chemiluminescence occurs when a mixture of 3% H_2O_2 in EtOH, EtOH–KOH, and an aq. extract of Lima beans, peas, roasted peanuts, or certain coffee beans is added to aq. NaOCl. Peas give the greatest effect. Na_2O_2–EtOH can replace NaOCl in the experiments described by Cottman (A., 1937, I, 430). A modification of the Trautz–Schorigin oxidation of pyrogallol + CH_2O by 3% H_2O_2 is described.

L. S. T.

Cathode luminescence. U. Fano (Physical Rev., 1940, [ii], **58**, 544—553).—Mathematical. Assuming a model in which surface effects prevail over luminescence in using radiation energy, a tentative theory is developed explaining experiments on the dependence of the brightness of a luminescent material on the voltage of electron bombardment.

N. M. B.

Luminescence excited by exposure to neutrons. (Miss) F. G. Wick and (Miss) M. S. Vincent (Physical Rev., 1940, [ii], **58**, 578).—Luminescence in $CaWO_4$, $CdWO_4$ activated by 1% of Mn, and phosphorescent ZnS on exposure to neutrons was recorded photographically. Faint thermoluminescence was shown by $\sim$30 other substances. Intensity is increased by the presence of some element highly reactive to neutrons or of some heavy element capable of absorbing radiations such as γ-rays. Materials excited by neutrons are also excited by *X*-rays, cathode rays, or the radiations from Ra. Slow neutrons are more effective than fast neutrons. An explanation of the luminescence is proposed.

N. M. B.

Mechanism of luminescence of crystalline phosphors. F. Möglich (Angew. Chem., 1940, **53**, 54—56).—A review of recent theoretical advances.

F. J. G.

Electric moments of morpholine and some halogenated toluenes. A. A. Maryott, M. E. Hobbs, and P. M. Gross (J. Amer. Chem. Soc., 1940, **62**, 2320—2324).—Measurements of electric moments in C_6H_6 at 30° give the following vals.: morpholine, 1·51; 3 : 5-dichloro-, 1·88, 3 : 5-dibromo-, 1·84, 2 : 4 : 6-trichloro-, 0·57, 2 : 4 : 6-tribromo-toluene, 0·73; 3 : 5 : 1-$C_6H_3Br_2{\cdot}CH_2Br$, 1·66; *p*-$C_6H_4Cl{\cdot}CCl_3$ 0·78 D. The influences of induction effects and resonance are discussed.

W. R. A.

Rotation of projection formulæ. G. N. Copley (Chem. and Ind., 1940, 717).—*d*- (lævo) and *l*- (dextro) -tartaric acid can be conventionally represented by clockwise and counterclockwise swastikas, respectively, to emphasise that in using projection formulæ of the Rosanoff or Fischer type only rotations in the plane of the paper are allowed.

L. J. J.

Resonance in the chloroacetic acids. E. C. Baughan (Nature, 1940, **146**, 461).—A criticism (cf. A., 1940, I, 285).

L. S. T.

Vibration frequencies and thermodynamic functions of long-chain hydrocarbons. K. S. Pitzer (J. Chem. Physics, 1940, **8**, 711—720).—Theoretical. A method is developed for calculating the vibration frequencies in long-chain mols., and is applied to the calculation of the thermodynamic functions of *n*-paraffins.

J. W. S.

Statistical mechanics of assemblies whose energy levels depend on temperature. G. S. Rushbrooke (Trans. Faraday Soc., 1940, **36**, 1055—1062).—Mathematical.

F. L. U.

Theory of depolymerisation of long-chain molecules. E. W. Montroll and R. Simha (J. Chem. Physics, 1940, **8**, 721—727).—Assuming that all linkages connecting monomeric units of a polymeride have equal probability of being broken, expressions are derived for the mol. size distribution in a depolymerised system as a function of the initial chain length and the degree of depolymerisation. Relationships are also given connecting the average mol. wt. of the product with the average no. of bonds split per mol.

J. W. S.

Explorations in stereochemistry. I. Problems of three-dimensional chemistry. II. Mechanism of gravitation, transmission of energy in space, and the luminiferous ether. III. Association of spheres and the space lattice. IV. Association of polyhedra. V. Effect of energy on the space lattice. VI. Preparation of tables of association in the simple cubic mode. VII. Stereochemistry of water. VIII. Stereochemistry of ice at atmospheric pressure. IX. Freezing point of water. X. Transmutations of the sulphur molecule. XI. The sulphuric anhydride–water reaction. S. Bull (Stereochem., 1937, **1**, 2—8, 18—26; 1938, **2**, 35—42, 49—54, 65—68, 81—85, 100—104, 112, 118—128, 137—140, 153—155, 162—166, 187—192; 1939, **3**, 11—16).—Mainly speculative.

Stereochemistry of the atmosphere. S. BULL (Stereochem., 1938, **2**, 43—45).

Stereochemistry of gold. S. BULL (Stereochem., 1938, **2**, 92—96).—A speculative review.

Stereochemistry of silicon dioxide. S. BULL (Stereochem., 1938, **2**, 129—136, 156—160).—Speculative.

Stereochemistry of hydrogen gold nitrate trihydrate. S. BULL (Stereochem., 1938, **2**, 97—99).

Stereochemistry of the octanes. S. BULL (Stereochem., 1938, **2**, 105—112).

Stereochemistry of benzene. S. BULL (Stereochem., 1938, **2**, 113—117).

Stereochemistry of the thiocyanates, thioureas, mustard oils, thiazoles, and allied substances. S. BULL (Stereochem., 1938, **2**, 167—175, 180—185).

Stereochemistry of ammonium copper chloride dihydrate. S. BULL (Stereochem., 1939, **3**, 1—10).—Mainly speculative. The prep. of the salt and some properties of its solutions are described.

Electron diffraction and chemistry of molecules in the gaseous state. A. L. G. REES (Chem. and Ind., 1940, 685—689).—Methods of interpretation of diffraction patterns and evidence bearing on resonance and polymerisation in org. and inorg. compounds are reviewed. A. J. E. W.

"Isosteric parachors." G. N. COPLEY (Chem. and Ind., 1940, 675—677).—The parachor increments ($[\Delta P]$) for elements in different valency states are corr. on the assumption that atoms in the same isosteric state possess equal $[\Delta P]$ vals. The changes obviate the need for singlet linkings and certain corrections for sp. at. groupings, and eliminate many outstanding anomalies. A diagram is given from which $[\Delta P]$ vals. for possible isosteres may be deduced. A. J. E. W.

Variation of bond strength with internuclear distance in a group of homologous diatomic molecules. R. F. BARROW (Trans. Faraday Soc., 1940, **36**, 1053—1055).—In a group of diat. oxides, sulphides, selenides, and tellurides of the IV (*b*) elements the plot of energy of dissociation against internuclear distance is linear. The type of binding in all the members is probably closely similar to that obtaining in the ground state of CO (cf. A., 1940, I, 348). F. L. U.

Bond length and bond strength. M. BURTON (J. Chem. Physics, 1940, **8**, 743; cf. A., 1940, I, 348).—It is pointed out that calculation from the bond lengths leads only to approx. vals. of the spectroscopic heat of dissociation (adiabatic bond strength), and not to the bond strength as usually defined (energy difference per mol. between the lowest energy state of a compound and the summed lowest energy states of the products formed by the rupture of the bond). J. W. S.

Structure of liquid argon. K. LARK-HOROVITZ and E. P. MILLER (Nature, 1940, **146**, 459—460).—The *X*-ray diffraction pattern of liquid A, with its four rings, is reproduced. The distribution function of the liquid is compared graphically with that of the solid. L. S. T.

Reflexion of *X*-rays with change of frequency. IV. Rock-salt. (SIR) C. V. RAMAN and P. NILAKANTAN (Proc. Indian Acad. Sci., 1940, **12**, **A**, 141—156).—The oscillation of the interpenetrating lattices of $Na^{\cdot}$ and Cl' ions in rock-salt varies the structure amplitudes of the crystal in such a way that halved spacings, which give strong unmodified reflexions, also give strong modified reflexions of *X*-rays and they are in the same order of relative intensities. Experimental data are in good agreement with theory and are satisfactorily represented by the modified Bragg formula $2d \sin \frac{1}{2}(\theta + \phi) = n\lambda$. W. R. A.

Lattice stress-strain diagram. W. A. WOOD and S. L. SMITH (Nature, 1940, **146**, 400).—*X*-Ray diffraction technique permits direct measurements of the displacements of atoms from their normal positions under stress and of their recovery when the stress is removed to be made simultaneously with the external load-extension diagram. Such a "lattice stress-strain diagram" for Fe is reproduced and discussed. On loading a specimen of metal two processes occur, viz., a contraction of the at. spacing which is reversible when the yield point is not exceeded, and some form of distortion, which results in a permanent expansion of the lattice, when the yield point is exceeded. L. S. T.

Theory of accessory formation [in crystals]. W. KLEBER (Fortschr. Min., 1937, **21**, 61—62; Chem. Zentr., 1937, i, 4917).—The mechanism described is based on the existence of mechanical and chemical imperfections in the crystal lattice, which affect the growth and disintegration processes. A. J. E. W.

Melting and crystal structure. J. W. H. OLDHAM and A. R. UBBELOHDE (Proc. Roy. Soc., 1940, **A**, **176**, 50—75; cf. A., 1939, I, 189).—The rôle of lattice flaws in melting and crystal structure is discussed. F.p. determinations on dioctyl ketone with $(CH_2Ph)_2$ as solute and on octadecane with $C_{10}H_8$ as solute indicate the presence of flaws in the crystals of polymethylene compounds. F.p. curves of mixtures of ketone ($C_{17}H_{34}O$) + paraffin ($C_{17}H_{36}$) and ketone ($C_{17}H_{34}O$) + ketone ($C_{18}H_{36}O$) show the importance of rotation of the CO group in melting and indicate that lattice flaws are easily formed without marked effect on m.p. A picture of melting is suggested in which a network of co-operative flaws breaks up the crystal into a mosaic. G. D. P.

Structure of liquid metals: a review. A. LATIN (J. Inst. Metals, 1940, **66**, 177—189).—From a crit. review of recent work it is concluded that, especially near the f.p., there are structural similarities between the liquid and cryst. metal; in cubic and hexagonal close-packed metals the solid melts to a liquid of closely allied structural characteristics, without any "group" formation, whereas in metals, the solid structure of which deviates appreciably from close-packing, a certain amount of transitory group formation (cybotaxis) occurs just above the m.p. Intermetallic compounds and eutectics appear to belong to the latter group, *i.e.*, they exhibit cybotaxis. A. R. P.

Diffuse reflexion of X-rays by single crystals. K. Lonsdale, I. E. Knaggs, and H. Smith (Nature, 1940, **146**, 332—333).—Experiments in which some thousands of diffuse spots have been obtained on Laue photographs are summarised. The main conclusions are that (i) the diffuse spots are due to characteristic radiation present in the incident beam; continuous radiation gives radial streaks; (ii) when a principal crystal axis is vertical, most of the diffuse spots are nearly coincident with Bragg spots on the corresponding oscillation photograph covering a range 10—15° on each side of the stationary position in which the Laue photograph is taken, and all diffuse spots can be accounted for by limited oscillations about the vertical axis and other principal crystallographic directions; (iii) the intensities of the spots depend on normal intensity of characteristic reflexion and separation of diffuse and Laue spots; (iv) the diffuse spot pattern almost disappears at the temp. of liquid air, and is enhanced at high temp.; (v) the pattern is not affected by covering the crystal surface with a drop of solvent, and (iv) the size of the diffuse spots shows that they are not given by small crystal units. Taylor and Laidler's views (A., 1940, I, 348) are criticised. L. S. T.

Crystallography of austenite decomposition. A. B. Greninger and A. R. Troiano (Amer. Inst. Min. Met. Eng., 1940, Tech. Publ. 1212, 25 pp.; Met. Tech., **7**, No. 5).—The orientation of the martensite crystals formed in various ways from plain-C and Ni steels was determined and plotted stereographically in relation to the orientation of the austenite grains from which the martensite was derived. The orientation habit of Fe–C martensite is definitely not octahedral, as has generally been supposed. For steels having $>1{\cdot}4\%$ C, the habit is $\{4\ 10\ 18\}\pm1°$, but for lower C contents it changes abruptly to $\{4\ 4\ 10\}_{\gamma}$. For steels near the eutectoid composition the martensite crystals are lath-shaped and parallel to $<110>_{\gamma}$. The formation of the martensite midrib has no relation to the C content. The structure resulting from austempering varies with the temp., is dissimilar to that of quenched martensite, and is probably formed from aggregates rather than single-phase particles. J. C. C.

Lattice distortion in plastically deformed α-iron. N. P. Goss (Amer. Inst. Min. Met. Eng., 1940, Tech. Publ. 1218, 15 pp.; Met. Tech., **7**, No. 5). —Measurements by a modified precision X-ray surface diffraction method support the view that deformation of low-C steel by cold-rolling does not distort the space lattice, but breaks up the grains into particles. This fragmentation proceeds until a lower limiting size of $\sim10^{-5}$ cm. is reached. This view can be used to explain the observed facts that the density of metals is reduced and the heat capacity increased by cold-working. J. C. C.

Accurate measurement of lattice constant of iron. V. Montoro (Metallurgia ital., 1937, **29**, 8—11; Chem. Zentr., 1937, ii, 14).—The val. $a = 2{\cdot}86072\pm0{\cdot}00003$ A. at 20° is obtained for Fe (C 0·018, Cu 0·026, S 0·002, P 0·008%) by the methods of Sachs and Weerts (A., 1930, 527) and Ievinš and Straumanis (A., 1936, 1449). A. J. E. W.

Water in hydrated compounds. F. J. Llewellyn (Chem. and Ind., 1940, 707—712).—H_2O in hydrated compounds can be classified as (i) H_2O of crystallisation in which H_2O mols. are co-ordinated around the cation, increasing its effective size so that more anions can be accommodated around it, giving a simpler and more close-packed structure; (ii) zeolitic H_2O which fills up spaces in a relatively independent structure; (iii) H_2O not co-ordinated with the cation, which is essential to the stability of the lattice and at the same time fills up spaces. The three classes are typified by the 6 octahedrally arranged H_2O in $NiSO_4,7H_2O$ and the 4 coplanar H_2O in $CuSO_4,5H_2O$, H_2O in zeolites, and the remaining H_2O in $NiSO_4,7H_2O$ and $CuSO_4,5H_2O$. H_2O in gypsum is intermediate between classes (ii) and (iii). L. J. J.

Dimorphism of diphenyloctatetraene crystals. K. S. Krishnan, S. L. Chorghade, and T. S. Ananthapadmanabhan (Nature, 1940, **146**, 333).—The crop of monoclinic crystals obtained from EtOAc solutions of the hydrocarbon contains also orthorhombic bipyramidal crystals, a 9·95, b 7·55, c 19·75 A., with 4 mols. of Ph·[CH:CH]$_4$·Ph per unit cell (cf. A., 1931, 551). L. S. T.

Crystal structure of picryl iodide. G. Huse and H. M. Powell (J.C.S., 1940, 1398—1402).—The structure of tetragonal crystals of picryl iodide has been investigated by Fourier synthesis from X-ray data. The mols. are arranged in four layers related by a four-fold screw axis. The centres of the mols. lie approx. on a face-centred cubic lattice. The three atoms of each NO_2-group lie in a plane inclined at 80° to the ring. The third NO_2 is coplanar with the ring, and its two O are related by the two-fold axis which passes through the mol. The I fits into a large hole in the structure. A. J. M.

Background in electron-diffraction patterns. A. Haque (Proc. Physical Soc., 1940, **52**, 777—795). —Intensity measurements were made on the scattering of electrons by Au films of various thicknesses prepared by sputtering on cellulosic substrates and on rock-salt. In the former case there was no regularity of scattering owing to a layer of substrate interlocked in the Au film in such a way that it could not be removed by repeated washing; in the latter case consistent results were obtained and detailed abs. measurements were made of the background for Au films of 395 and 750 A. thickness. The distribution function of the background is almost const. within the range 2—4°. The uniform background is probably due to plural inelastic scattering accompanied by diffuse scattering due to the thermal motion of the atoms in the crystallites. N. M. B.

Molecular structure of nitrogen dioxide and nitric acid by electron diffraction. L. R. Maxwell and V. M. Mosley (J. Chem. Physics, 1940, **8**, 738—742; cf. A., 1934, 835).—Previous measurements on NO_2 are extended to include greater angles of scattering. The results indicate that the O–N–O angle is $130\pm2°$, and the N—O distances are $1{\cdot}21\pm0{\cdot}02$ A. Measurements on HNO_3 vapour at 70—85° indicate that if the NO_3 group is planar it contains an NO_2 group with the same structure as in NO_2

gas, the third O being $1{\cdot}41 \pm 0{\cdot}02$ A. from the N and equidistant from the other O. A model with the N slightly out of the plane of the O atoms also accords with the results, but is considered less probable in view of Raman spectral data (Chédin, A., 1939, I, 550). J. W. S.

Electron diffraction investigation of the structure of propylene bromide. V. SCHOMAKER and D. P. STEVENSON (J. Amer. Chem. Soc., 1940, **62**, 2423—2426).—Propylene bromide has a *trans*-configuration with respect to Br atoms, with C—Br distance of $1{\cdot}92 \pm 0{\cdot}02$ A., and angle C–C–Br $= 110 \pm 1°$. The mol. is essentially rigid except for a torsional oscillation of amplitude of $\pm 19 \pm 5°$ corresponding with a potential barrier of 12 ± 5 kg.-cal. per mol. W. R. A.

Structure of thionyl bromide. D. P. STEVENSON and R. A. COOLEY (J. Amer. Chem. Soc., 1940, **62**, 2477—2479).—From analysis of electron-diffraction photographs for SO_2Br_2 vapour the S—Br distance is $2{\cdot}27 \pm 0{\cdot}02$ A. (which is $0{\cdot}09$ A. > the sum of at. radii), the Br—O distance is $3{\cdot}05 \pm 0{\cdot}03$ A., and the angle Br–S–Br is $96 \pm 2°$. W. R. A.

Law of Magnus in single-crystal aluminium wires. C. Y. MA and W. BAND (Physical Rev., 1940, [ii], **58**, 479—480).—Single crystals up to 60 cm. length produced in pure Al wires 1 mm. diameter by the travelling temp. gradient method were examined for the Benedicks e.m.f. under asymmetrical temp. distributions when uniformly crystallised and when made artificially non-uniform at a given point by overheating. This portion behaved as a thermo-electrically different substance and was a hard poly-cryst. section in the wire. If annealing has removed impurity nuclei which cause Benedicks e.m.f., it is suggested that remaining traces of permanent impurity nuclei are incorporated in the lattice of the single-crystal part of the wire, their thermo-electric effect being lost. In the polycryst. section this solid solution does not occur, and the impurity atoms form the " cement " between the polycrystals, and change the thermo-electric properties of the aggregate. Hence there is no contradiction with the law of Magnus in uniformly aligned Al. N. M. B.

Properties of Rochelle salt. III. H. MUELLER (Physical Rev., 1940, [ii], **58**, 565—573; cf. A., 1940, I, 287).—The interaction theory is extended by supplementing the expression for the free energy of the deformed and polarised crystal by a term $\propto$ the 4th power of the polarisation in the *a* direction. This second approximation explains the dielectric and elastic saturation phenomena above the upper Curie point and the dielectric, elastic, piezoelectric, and pyroelectric properties in the ferroelectric temp. range. Experimental results are compatible with the hypothesis that the clamped crystal has only one transition point at $\sim 5°$, where its ϵ has a very high max. The two Curie points of the free crystal are due to the interaction between the elastic deformation and the electric polarisation. Instead of sudden changes of the heat capacity, the new theory predicts slight changes of the slope of the sp. heat curve at the Curie points. The dispersion of ϵ is explained without assuming a relaxation time. N. M. B.

Cyanamide, dicyanodiamide, and melamine. Optical and crystallographic properties. T. G. ROCHOW, R. W. STAFFORD, D. W. DAVIS, and R. L. GILBERT (Ind. Eng. Chem., 1940, **32**, 1187—1188).—Physical consts. are recorded, and photomicrographs are shown, for these compounds, all of which can be obtained from $CaCN_2$. Commercial uses of the products are given. A. T. P.

Optical phenomena in active crystals. G. SZIVESSY (Fortschr. Min., 1937, **21**, 111—168; Chem. Zentr., 1937, i, 4917—4918).—The theory of the optical properties of a crystal lattice is reviewed. Interference phenomena due to a parallel beam of plane-polarised light passing perpendicularly through an optically active cryst. plate are discussed. Details are given of recent work on the optical activity of quartz. A. J. E. W.

Polymorphism and growth in solid phases. J. LEONHARDT (Fortschr. Min., 1937, **21**, 69—71; Chem. Zentr., 1937, ii, 3).—The concept of crystal growth is explained; changes of cryst. form in polymorphic solids are regarded as growth effects. Recrystallisation and the transition from single-crystal to mosaic crystal are discussed with reference to KNO_3. The formation of nuclei is an important stage in all the above processes; a distinction is drawn between " bound " and " free " nuclei. A. J. E. W.

Molecular relaxation and the elastic and dielectric properties of plastics. L. HARTSHORN, N. J. L. MEGSON, and E. RUSHTON (Proc. Physical Soc., 1940, **52**, 817—821).—The elastic modulus E for 6 thermoplastics is calc. by Maxwell's relation $\eta = G\tau$, where G is the modulus of rigidity and τ the time of relaxation of the mols. deduced from dielectric properties. For the phenolic thermoplastics the calc. vals. are almost independent of hard–very soft state, and support Kuhn's suggestion (cf. A., 1939, I, 192) that the true E has nearly the same val. for all materials and that differences in elastic behaviour are due to differences in the rates of decay of stresses on account of mol. relaxation. The true E for materials with large mols. is considered to represent the total effect of many kinds of mol. forces, each with its own τ, and it is the distribution of these τ which determines the general character of the observed stress–strain relationship. The val. of τ deduced from dielectric behaviour refers only to that group of forces due to the polar constituents of the mols. For thermoplastics, the same vals. of τ must represent approx. all the mol. forces involved in elasticity and viscosity. For the benzyl alcohol resin the equation does not give the true E, probably because there are relatively few polar groups and τ for these is less representative of the mol. forces as a whole. (Cf. B., 1940, 744.) N. M. B.

Molecular rotation and polymorphism in methylchloromethanes. A. TURKEVICH and C. P. SMYTH (J. Amer. Chem. Soc., 1940, **62**, 2468—2474).—Dielectric consts. and sp. conductances of CMe_2Cl_2 in the temp. range 18° to −106° and of $CMeCl_3$ in the range 2° to −123° at 0·5, 5, and 50 kc. have been measured. CMe_2Cl_2, $Bu^{\gamma}Cl$, $CMeCl_3$, CCl_4, and CMe_4 solidify to cubic crystals, the mols. of which have practically the same freedom of rotation as in

the liquid state. With decreasing temp. this freedom is lost as the high-temp. isotropic form undergoes a sharp transition to a low-temp. anisotropic form. Temp.–time curves for $Bu^{\gamma}Cl$ and CCl_4 indicate a complete series of solid solutions. W. R. A.

Electric strength of some solid dielectrics. A. E. W. Austen and S. Whitehead (Proc. Roy. Soc., 1940, **A**, **176**, 33—50).—The electric strengths of mica, quartz, and KBr were measured and found to be in agreement with theory. The variation of electric strength with temp. was found to conform to theory for KBr and mica up to 400°. The increase of electric strength when the thickness of mica is reduced was investigated. Fused SiO_2 has a higher electric strength than quartz. Tests were also carried out on bakelite, shellac, bituminous and natural oil varnishes. The electric strength of films of these complex org. dielectrics decreases with temp., so that Fröhlich's theory does not apply. G. D. P.

Electrical conductivity of pure metals. W. J. de Haas and G. J. van den Berg (Comm. Kamerlingh Onnes Lab., 1937, Suppl. 82*a*, 10 pp.; Chem. Zentr., 1937, i, 4202).—Resistance measurements at 1—20° K. show that the formula $R_T/R_0 = AT^B$ (R_T, R_0 = resistance at T° K. and 0° C.) is not applicable to Pt, Cu, or Tl. Other metals conform to this formula, and give the following B vals.: Au 4·2, Pb 5·0, Cd ~4·5, Sn 4·3, Ag 4·1. A. J. E. W.

Increase of electrical resistance in a magnetic field. Diamagnetism. W. J. de Haas and J. W. Blom (Comm. Kamerlingh Onnes Lab., 1937, Suppl. 82*c*, 19 pp.; Chem. Zentr., 1937, i, 4202).—The effect of the intensity and orientation of a magnetic field on resistance has been examined with single crystals of Bi (at liquid He temp.) and Ga. Other highly diamagnetic substances (Sb, graphite, Zn–Cu alloy) have also been studied. A. J. E. W.

Superconductivity. W. J. de Haas, O. A. Guinau, and J. M. Casimir-Jonker (Comm. Kamerlingh Onnes Lab., 1937, Suppl. 82*d*, 19 pp.; Chem. Zentr., 1937, i, 4202).—The crit. magnetic field required to inhibit superconductivity has been determined by resistance measurements on a no. of cylindrical single crystals. The penetration of the field into the cylinders was deduced from the resistance of Bi wires in their interior. A. J. E. W.

Structure of compounds containing S–O and S–Cl bonds. I. Introduction. Derivatives of $[SO_4]^{-2}$ and $[S_2O_3]^{-2}$ radicals. II. Derivatives of $[SO_3]^{-2}$ and $[S_2O_2]^{-2}$ radicals. A. Clow, H. M. Kirton, and J. M. C. Thompson (Trans. Faraday Soc., 1940, **36**, 1018—1028, 1029—1033; cf. A., 1937, I, 451).—I. Diamagnetic susceptibilities (χ) of $KEtSO_4$, $NaEtS_2O_3$, S_2Cl_2, and SCl_2 have been measured and compared with those calc. for various types of linking for which the corresponding depressions are derived. The results eliminate the possibility of double-bonding in the first three compounds, the structures of which are given as $\begin{matrix}K{\cdot}O\\Et{\cdot}O\end{matrix}\!>\!S\!<\!\begin{matrix}\nearrow O\\\searrow O\end{matrix}$, $\begin{matrix}Na{\cdot}O\\Et{\cdot}S\end{matrix}\!>\!S\!<\!\begin{matrix}\nearrow O\\\searrow O\end{matrix}$, and Cl·S·S·Cl. Structures of SO_3 and $ClSO_3H$ are discussed.

II. χ vals. have been measured for several sulphites and sulphonates and their thio-derivatives, and are used to discuss their structures. Inorg. sulphites are asymmetric, with co-ordinate linkings between S and two O atoms. The org. sulphites and thiosulphites appear to be resonance hybrids of $(RO)_2S{\rightarrow}O$ and $(RO)_2S{:}O$, and $(RS)(RO)S{\rightarrow}O$ and $(RS)(RO)S{:}O$, respectively. For sulphonates structures other than $\begin{matrix}M{\cdot}O\\R\end{matrix}\!>\!S\!<\!\begin{matrix}\nearrow O\\\searrow O\end{matrix}$ are eliminated. Magnetic data cannot distinguish between a similar structure for thiosulphonates and one representing them as disulphoxides. F. L. U.

Magnetic susceptibilities of solutions of sodium and potassium nitrates. S. P. Ranganadham and M. Qureshi (Indian J. Physics, 1940, **14**, 129—134).—The magnetic susceptibilities of aq. $NaNO_3$ and KNO_3 of various concns. have been measured by Quincke's method, and from the data the val. for the NO_3' ion has been deduced (—20·1 in $NaNO_3$ and —18·5 in KNO_3, both $\times 10^{-6}$). W. R. A.

Molecular structure of some selenium compounds determined by magnetic method. M. Prasad and S. S. Dharmatti (Proc. Indian Acad. Sci., 1940, **12**, **A**, 185—198).—An extension of work already noted (A., 1940, I, 313). The diamagnetic susceptibilities ($-\chi \times 10^6$) of Se_2Br_2, Se_2Cl_2, H_2SeO_3, Ag_2SeO_3, and $SeOCl_2$ are 112·6, 94·79, 45·41, 102·2, and 48·65, respectively. The structures of these mols. are discussed and it is concluded that (i) the halides are linear, X·Se·Se·X, (ii) H_2SeO_3 and Ag_2SeO_3 are $\begin{matrix}O\\O\end{matrix}\!\gg\!Se\!<\!\begin{matrix}O{\cdot}H(Ag)\\H(Ag)\end{matrix}$, and (iii) that $SeOCl_2$ is Y-shaped, $O{:}Se\!<\!\begin{matrix}Cl\\Cl\end{matrix}$. Vals. for Se^{+2}, Se^{+4}, and Se^{+6} have been calc. by the methods of Slater and of Angus and by modifications of these methods, and are employed in deciding between possible mol. constitutions. W. R. A.

Molecular structure of some tellurium compounds determined by magnetic method. S. S. Dharmatti (Proc. Indian Acad. Sci., 1940, **12**, **A**, 212—222).—An extension of work already noted (A., 1940, I, 313). The diamagnetic susceptibilities ($-\chi \times 10^6$) of H_2TeO_3, $TeCl_2$, $TeBr_2$, $H_2TeO_4,2H_2O$, $TeMe_2I_2$, and $TeMe_2Cl_2$ are 34·89, 94·45, 106·20, 57·53, 145·40, and 92·43 respectively in good agreement with calc. vals. (cf. preceding abstract). Vals. of χ for Te^{+2}, Te^{+4}, and Te^{+6} have been calc. and are used in assigning mol. structures. It is concluded that $TeCl_2$ and $TeBr_2$ are non-linear, that H_2TeO_3 has a similar structure to H_2SeO_3, and that $H_2TeO_4,2H_2O$ has a planar structure corresponding with $Te(OH)_6$. W. R. A.

Relation between velocity of sound in liquids and molecular volume. M. R. Rao (Indian J. Physics, 1940, **14**, 109—116; A., 1940, I, 104).—Extension of previous work to Et_2O, NH_2Ph, $COMe_2$, $CHBr_3$, MeOH, glycerol, p-$C_6H_4Cl_2$, and $C_6H_4Me{\cdot}NO_2$. W. R. A.

"λ-Phenomenon" in helium. W. H. Keesom (Comm. Kamerlingh Onnes Lab., 1936, Suppl.

80*b*, 26 pp.; Chem. Zentr., 1937, i, 4072).—A review. A. J. E. W.

Hindered rotation in methyl alcohol. B. L. CRAWFORD, jun. (J. Chem. Physics, 1940, **8**, 744).—The conclusion of Koehler and Dennison (A., 1940, I, 311) that the height of the barrier hindering internal rotation in MeOH is probably $\sim 470 \pm 40$ cm.$^{-1}$ is shown to be inconsistent with the third-law entropy data, which indicate a potential of ~ 1200 cm.$^{-1}$ J. W. S.

Hindered internal rotation of methyl groups. Entropy of silicon tetramethyl. J. G. ASTON and R. M. KENNEDY (J. Amer. Chem. Soc., 1940, **62**, 2567).—The potential hindering internal rotation of Me in $SiMe_4$ is 1280 g.-cal. compared with 4800 g.-cal. in CMe_4 in contradiction to an anticipated higher val. if this potential were due chiefly to a lack of cylindrical symmetry in bond orbitals arising from electron interactions. The potential is assumed to arise from H repulsions. The vals. of the entropy of $SiMe_4$ at 227·0° and 299·8° K. are 80·50 and 87·81 g.-cal. per degree per mol. respectively from spectroscopic data and 77·94 and 86·33 from calorimetric measurements. W. R. A.

Specific heat of liquid methyl chloride. J. H. AWBERY and E. GRIFFITHS (Proc. Physical Soc., 1940, **52**, 770—776).—Data for the range −30° to 30° are reported. The liquid was in a sealed container provided with a heating coil in a re-entrant tube and was stirred by an external solenoid operating on an Fe armature. The calorimeter was surrounded by an adiabatic enclosure. Data determined include the latent heat of the liquid vaporised and the heat supplied to warm the vapour in the calorimeter. This was reduced to give the sp. heat of the liquid following saturation. Results accord with available data. N. M. B.

Calculation of the heat capacity and entropy of methylamine from spectroscopic data alone. Torsional mode of vibration. J. G. ASTON and P. M. DOTY (J. Chem. Physics, 1940, **8**, 743—744).—The heat capacity and entropy of NH_2Me have been calc. from infra-red absorption spectral data (A., 1940, I, 194), fairly good agreement being obtained with the observed val. of the heat capacity and the entropy derived from the third law of thermodynamics. J. W. S.

Thermal hysteresis at the transition of hydrogen bromide at 89° K. A. EUCKEN and W. GÜTTNER (Nachr. Ges. Wiss. Göttingen, Math.-phys. Kl., II, 1937, **2**, 167—180; Chem. Zentr., 1937, i, 3769—3770; cf. A., 1938, I, 507).—Heating and cooling curves obtained with an improved calorimeter are used to study the thermal hysteresis effect in HBr at the " rotational transition point " at 89·5° K. The hysteresis loop has a max. width of 0·52°; it is independent of purity and crystal size, and is unaffected by exposing the HBr to ultrasonic waves or by addition of slightly warmer HBr crystals as nuclei. The considerable stability of the effect is thus demonstrated. A. J. E. W.

***P–V–T* relations of propylene.** W. E. VAUGHAN and N. R. GRAVES (Ind. Eng. Chem., 1940, **32**, 1252—1256).—A study of C_3H_6 over the ranges 0—300° and 2—80 atm. has been made. Vals. for the compressibility factor, heat of vaporisation, and various properties of saturated liquid and vapour are recorded in tabular and graphical form. Crit. vals. are θ_c 91·4°; P_c 45·4 atm.; V_c 180 c.c. per mol.; ρ_c 0·233 g. per c.c. C. R. H.

Thermodynamic properties of the hexyl alcohols. V. ββ-Dimethylbutan-α-ol and β-ethylbutan-α-ol. F. HOVORKA, H. P. LANKELMA, and W. R. SMITH (J. Amer. Chem. Soc., 1940, **62**, 2372—2374).—V.p. of both compounds have been measured from 5° to b.p. (136·69±0·02° and 146·27±0·02°, respectively) and from these data heats of vaporisation and Trouton consts. have been deduced. η, ρ, and γ have been measured throughout the same temp. range and n from 15° to 45°. Vals. of parachor, Eötvös const., total surface energy, crit. temp., degree of association, and mol. refraction have been computed. W. R. A.

Nomograph for the Clausius–Clapeyron equation. C. L. CRAWFORD (Ind. Eng. Chem., 1940, **32**, 1280).—A nomograph giving directly the latent heat from known v.p. vals. at two temp. has been constructed and is reproduced. C. R. H.

Thermal conductivity of metals. C. C. BIDWELL (Physical Rev., 1940, [ii], **58**, 561—564).—The relation $k/C\rho = K/T + K'$ previously reported (cf. A., 1928, 1083), where k = thermal conductivity and C = at. heat, is shown to be in agreement with recent theories on the metallic state. K/T relates to conduction by the crystal lattice, and K', referring to conduction by electrons, is found experimentally to be the conductivity in the molten state. These relations are plotted for Pb, Sn, and Zn, with new data for Pb. N. M. B.

Liquid state. J. E. LENNARD-JONES (Proc. Physical Soc., 1940, **52**, 729—747).—A review of the present state of knowledge of liquids shows that the fundamental problem is the calculation of entropy. The concepts of order and disorder in connexion with theories of melting, the determination of the average distribution of atoms by *X*-ray diffraction and by the calculation of distribution functions from known at. forces, and the significance of observations on viscosity and sp. heats are discussed with reference to the theory of liquid structure. N. M. B.

Viscosity of liquids. E. N. DA C. ANDRADE (Proc. Physical Soc., 1940, **52**, 748—758).—A discussion of η of various classes of liquids at the m.p., and of the effect of an electric field on η. N. M. B.

Relations between thermo-physical properties [of liquids]. A. FERGUSON (Proc. Physical Soc., 1940, **52**, 759—763).—A discussion of various relations which hold over the whole f.p.—crit. temp. range shows that two simple relations demanding an explanation in terms of modern theory are the power law connecting surface tension and temp., and the relation between surface tension and density independent of temp. N. M. B.

Distribution function of a simple liquid model. J. CORNER (Proc. Physical Soc., 1940, **52**, 764—767; cf. Coulson, A., 1940, I, 99).—Mathematical. N. M. B.

Theory of holes in liquids. R. Fürth (Proc. Physical Soc., 1940, **52**, 768—769).—The assumption of a large no. of small holes of the order of magnitude of at. radii in liquids is the counterpart of the groups or at. clusters in dense gases or vapours. The interpretation of the properties of liquids in terms of these holes and the estimation of their no. and size are discussed. N. M. B.

Pressure and temperature effects on the viscosity of liquids. D. Frisch and H. Eyring (J. Appl. Physics, 1940, **11**, 75—80).—At low pressures the heat of activation for viscous flow is about one third of the energy of vaporisation, but with increasing external pressure it increases rapidly owing to the increased work term (product of the external pressure and the extra vol. required before flow can occur). Calculations of the variations of η with pressure for *n*- and *iso*-C_5H_{12}, Et_2O, C_6H_6, H_2O, and Hg are in accord with experiment and indicate that this effect can be calc. from thermodynamic data only. J. W. S.

Viscosity and the shape of protein molecules. J. W. Mehl, J. L. Oncley, and R. Simha (Science, 1940, **92**, 132—133).—The asymmetry of protein mols. is discussed in terms of the hydrodynamic behaviour of ellipsoids. L. S. T.

Internal friction of aluminium. R. H. Randall and C. Zener (Physical Rev., 1940, [ii], **58**, 472—473; cf. A., 1939, I, 555).—Measurements over a range of grain size and of frequency show that the internal friction of Al is <1/10 that of α-brass under corresponding conditions, as demanded by the nearly elastic isotropy of Al. N. M. B.

Young's modulus of diamond. P. R. Pisharoty (Proc. Indian Acad. Sci., 1940, **12**, **A**, 208—211).—By an improvement of Voigt's "scale and telescope" method for determining the Young's modulus (Ann. Physik, 1887, **31**, 474) the val. for diamond in any direction lying in the octahedral plane is $5{\cdot}5 \times 10^{12}$ dynes per sq. cm. W. R. A.

Dependence of thermal diffusion on the concentration ratio. S. Chapman (Nature, 1940, **146**, 431).—A discussion. L. S. T.

Apparent molar volumes of salts in ammoniacal and aqueous solution. E. I. Achumov (J. Gen. Chem. Russ., 1940, **10**, 233—246).—The apparent mol. vol., ϕ, of a solute is defined as $\phi = (V - V_0)/n$, where V is the vol. of solution, V_0 that of solvent contained therein, and n is the no. of g.-mols. of solute in solution. In general, ϕ rises with increasing concn. of solute, and is considerably less for solutions in NH_3 than in H_2O. The vols. of the systems NH_4Cl–, NH_4Br–, and NH_4NO_3–H_2O are >, and of the systems NH_4Cl–, NH_4Br–, NH_4NO_3–, NaCl–, and $NaNO_2$–NH_3, and NaCl– and $NaNO_2$–H_2O <, those given by the additive rule; in NaCl– and $NaNO_2$–NH_3 the vol. of the systems may be < that of the solvent alone. R. T.

Surface tension in the system hydrazine–water at 25°. N. B. Baker and E. C. Gilbert (J. Amer. Chem. Soc., 1940, **62**, 2479—2480).—Vals. of γ at 25° have been determined by the max. bubble pressure method for aq. N_2H_4 throughout the entire concn. range and show max. corresponding with the compound $N_2H_4,2H_2O$, salts of which are unknown. Vals. of parachor have been deduced and [*P*] for N_2H_4 at 25° is 91·5. Max. deviation from linearity in parachor vals. occurs at approx. 50 mol.-% in agreement with Semishin's phase diagram results (A., 1939, I, 68). W. R. A.

Physical properties of morpholine–water solutions. H. B. Friedman, A. Barnard, W. B. Doe, and C. L. Fox (J. Amer. Chem. Soc., 1940, **62**, 2366—2367).—Sp. gr., *n*, η, and γ have been measured at 20° for aq. solutions containing from 8·558 to 100% of morpholine. W. R. A.

Quenching of fluorescence in solution. II. Temperature and solvent effects. R. W. Stoughton and G. K. Rollefson (J. Amer. Chem. Soc., 1940, **62**, 2264—2268; cf. A., 1939, I, 597).—The quenching has been investigated (i) of quinine sulphate by 0·005M-KCl from 0° to 70°, (ii) of fluorescein in 0·001M-KOH by 0·05M-KI in the same temp. range, (iii) of fluorescein in 0·001M-KOH by 0·8M-KI in H_2O, glycerol (I)–H_2O, $(CH_2{\cdot}OH)_2$–H_2O, and MeOH–H_2O mixtures at 25°, (iv) of acridone (II) by 0·01M-KI from 0° to 75°, (v) of (I) by 0·2M-KI in (I) from 3° to 72°, and (vi) of (II) by KI in (I)–H_2O and $(CH_2{\cdot}OH)_2$–H_2O mixtures at 25°. Quenching is reduced as η increases and increases with rising temp. It changes with ionic strength in solvents of different dielectric const. as predicted by the Debye–Hückel theory and the Brönsted equation for bimol. reactions, whilst at zero ionic strength quenching changes according to Scatchard's equation. W. R. A.

Compound formation in solutions. I. Pyridine and acetic acid. S. Venkataraman (J. Indian Chem. Soc., 1940, **17**, 297—303).—Optical properties and magnetic susceptibilities of C_5H_5N–AcOH mixtures of varied composition indicate the formation of a complex with C_5H_5N 40 mol.-%. The max. of the η curve is, however, at C_5H_5N 22 mol.-%. F. L. U.

Organic molecular compounds. IV. Relation between compound formation and the substituent in the monosubstitution products of several aromatic hydrocarbons. C. Shinomiya (Bull. Chem. Soc. Japan, 1940, **15**, 281—288).—The tendency to mol. compound formation with α-$C_{10}H_8$ derivatives is > than with β-derivatives, and the effect of substituents is in the order NH_2 > Me > OH > Et > OMe > Cl > Br > OEt > H > CO_2H > CO_2Me > OPh > CN > COPh > NO_2. M.p. data on the binary systems of 1-$C_{10}H_7{\cdot}NO_2$ (*A*), 2-$C_{10}H_7{\cdot}NO_2$ (*B*), 1-$C_{10}H_7{\cdot}OAc$ (*C*), or 1-$C_{10}H_7{\cdot}CO_2Me$ (*D*) with $C_6H_3(NO_2)_3$ (*E*), picric acid (*F*), and $C_6H_2(NO_2)_4$ (*G*) are given, and the following *compounds* are described: *AE*, m.p. 71°; *AE*$_2$, m.p. 70·0°; *AF*, m.p. 72·0°; *BE*, m.p. 75·5°; *CE*, m.p. 71°; *CF*, m.p. 80°; *CG*, m.p. 79·5°; *DE*, m.p. 105·5°; *DF*, m.p. 72·5°. F. J. G.

Atomic consideration of immiscibility in glass systems. B. E. Warren and A. G. Pincus (J. Amer. Ceram. Soc., 1940, **23**, 301—304).—Miscibility is favoured by the tendency of the network-forming cations Si, B, and P to bond with all the available O

ions and immiscibility is favoured when other cations such as Na and Ca are not properly surrounded by unsaturated O ions. The comparative electrostatic bonding energy may be calc. from the size and valency of the ions. Not only can the complete miscibility of the Na_2O-SiO_2 system be predicted, but the limits of miscibility for the $CaO-SiO_2$ and the $CaO-B_2O_3$ systems can also be approx. calc. A qual. explanation is given for the effect of 1% of Na_2O or Al_2O_3 in causing complete miscibility in the $CaO-SiO_2$ system.

J. A. S.

Colours in stratified media. I. Ancient decomposed glass. (SIR) C. V. RAMAN and V. S. RAJAGOPALAN (Proc. Indian Acad. Sci., 1940, **11**, **A**, 469—482).—The structure of films of decomposed glass from an ancient Syrian vase has been investigated microscopically and the iridescence of the films examined spectroscopically. Iridescence is not due, as suggested by Brewster (1863), to films of air separating thin layers of glass. The material is optically and mechanically continuous with an open, stratified framework. Liquids can penetrate into the film but the film does not become homogeneous nor cease to reflect unless the liquid has the same n (1·465) as the glass. W. R. A.

Arrangement of phases in palladium–hydrogen. D. P. SMITH and C. S. BARRETT (J. Amer. Chem. Soc., 1940, **62**, 2565—2566).—The α and β phases in the diffusion system $Pd-H_2$ are shown by X-ray diffraction methods to be completely segregated. Changes in gross composition are accompanied by migration of the phase boundary, the intensity of the high diffraction lines from the β phase being $\ll$ those from the α phase. The α phase occupies all the region in which $[H_2]$ is $<$ a certain saturation limit, only the β phase being present when this limit is exceeded. The application of the method for exact measurement of rate of diffusion is discussed.

W. R. A.

Solubility of certain elements in copper and in silver. E. A. OWEN and V. W. ROWLANDS (J. Inst. Metals, 1940, **66**, 361—378).—The solid solubilities of Ga, Ge, and As in Cu and in Ag have been determined by a precision X-ray method on thoroughly annealed samples at temp. up to the peritectic. The vals. found are (at.-%): Ga in Cu 18·8 at 300°, 19·7 at 620° (eutectoid temp.), and 16·4 at 914° (peritectic); Ge in Cu 8·7 at 200°, 10·4 at 600°, and 11·4 at 821° (peritectic); As in Cu 6·0 at 215° and 6·8 at 688° (peritectic); Ga in Ag 14·9 at 300° and 17·8 at 615° (peritectic); Ge in Ag 1·5 at 270° linearly to 9·6 at 651° (peritectic); As in Ag 4·2 at 296°, 6·5 at 400°, and 8·8 at 595° (peritectic). In both series of alloys there is a linear relation between the vol. of the solute at max. solubility and the lattice distortion produced, the distortion for the Cu series being strictly $\propto$ the vol. of solute and that of the Ag series $\propto$ to a quantity $>$ the vol. of solute. Alloys of Zn with Cu and Ag conform to the same rules.

A. R. P.

Densities of the silver-rich zinc–silver alloys: calculation of densities from lattice parameters. D. STOCKDALE (J. Inst. Metals, 1940, **66**, 287—310). —The d of Zn–Ag alloys with up to 40 at.-% of Zn, prepared in evacuated tubes, have been determined by an exact method. The results can be approx. described by the equation $d = 10{\cdot}50018 - 0{\cdot}027179C - 3{\cdot}195 \times 10^{-5}C^2$ (C is the at.-% of Zn); very small, but definite, deviations occur at 20 and 28 at.-% of Zn. Precision measurements of the lattice parameters of some of the alloys are given and a simple method for calculating the d of metals and alloys from their parameters is described. The max. d found for pure Ag at 20° was 10·5000. A. R. P.

Constitution of lead-rich alloys of lead, antimony, and cadmium. E. C. ROLLASON and V. B. HYSEL (J. Inst. Metals, 1940, **66**, 349—353).—The system up to Sb 15 and Cd 20% has been examined by thermal, resistivity, and micrographical methods and the results are shown in vertical and horizontal sections of the ternary model. The ternary liquidus surface comprises four areas corresponding with the separation of the α, β, δ (Pb-, Sb-, and Cd-rich solid solutions respectively) phases, and the γ phase (CdSb). Pb and γ form a pseudobinary system with a eutectic at 275°, Cd 4·32, Sb 4·68%. Ternary eutectics occur at 236°, Cd 18·5, Sb 2·5%, and 242°, Cd 1·3, Sb 11·3%. Pb dissolves 2·5% of CdSb at 275° and $<$0·3% at 25°. Cd greatly reduces the solubility of Sb in Pb but Sb has little effect on the solubility of Cd.

A. R. P.

Alloys with composition near Al_2Cu. G. S. RUSHBROOKE (Proc. Physical Soc., 1940, **52**, 701—706).—An explanation based on free energy considerations is given for the experimental finding that there is no stable single-phase alloy of the exact composition Al_2Cu, although there is a small range of compositions lying a little to the Al-rich side of this for which such single-phase alloys exist (cf. Stockdale, A., 1933, 1111).

N. M. B.

Aluminium–tungsten equilibrium diagram. W. D. CLARK (J. Inst. Metals, 1940, **66**, 271—286).— Alloys of Al with $\ngtr$30% of W can be prepared by melting and casting, but those richer in W must be made by sintering powder mixtures. The mutual solubility of the metals is $\sim$2%; there is no eutectic but seven intermediate phases are formed by peritectic reactions. The γ phase with W 36—37% is formed at 697° from liquid + δ and reacts with α at $\sim$580° to form β. The δ phase is formed by a peritectic reaction at 870° and has a narrow range of composition around 60% of W. The ε phase corresponds with Al_4W and appears to be monoclinic and to be formed by a peritectic reaction at 1326° between liquid + η. Above 1300° in alloys containing $>$66% of W there is a complex series of small phase fields involving the η, η', and η'' phases formed by peritectic reactions at 1344°, 1420°, and 1650°, respectively; these phases decompose by peritectoid reactions at 1300°, 1317°, and 1335° respectively into ε + W, η + W, and η' + W. Characteristic photomicrographs of the structure of the alloys in the different phase regions are reproduced. A. R. P.

Properties of alloy equilibrium diagrams derived from the principle of lowest free energy. H. LIPSON and A. J. C. WILSON (Iron and Steel Inst., Advance copy, 1940, 12 pp.).—Theoretical. The use of the principle of lowest free energy, as distinct from

the phase rule, in constructing equilibrium diagrams for alloy systems is discussed. This principle is able to give more information about the co-existence of phases in equilibrium in binary systems than can the phase rule. Roozeboom's theorems regarding ternary systems are derived much more simply by applying the free energy principle. C. R. H.

Structure of alloys. A. J. Bradley, W. L. Bragg, and C. Sykes (Iron and Steel Inst., 1940, Advance copy, 80 pp.).—A review of recent work on binary and ternary diagrams of systems containing the components Fe, Ni, Co, Cr, Cu, and Al is followed by a discussion of the results obtained in *X*-ray investigations of the order–disorder transformations in β-brass, Cu_3Au, Cu_3Pd, and Ni_3Fe. A. R. P.

Mechanism of mutual solubility of water and β-ethylhexanol. S. Bull (Stereochem., 1938, **2**, 143—144).—Speculative.

Solubility of iodine in water. S. Bull (Stereochem., 1938, **2**, 175—176).

Hydrogen bonds involving the C–H linking. X. Solubility of donor solutes in halogenated hydrocarbons. C. S. Marvel, F. C. Dietz, and M. J. Copley (J. Amer. Chem. Soc., 1940, **62**, 2273—2275; cf. A., 1940, I, 108).—Donor solutes are more sol. in partly than in completely halogenated hydrocarbons owing to CH←O and CH←N linkings. Polymeric esters and ketones are thus much more sol. in $CHCl_3$ and $(CHCl_2)_2$ (less so in $CHCl_3$) than in CCl_4 or C_2Cl_4, but this does not apply to polyvinyl chloride and cellulose acetate owing to solute–solute co-ordination. These and data from the literature show that co-ordinate linkings are not the sole factors governing solubility. R. S. C.

Solubility of lead iodate in ammonium acetate solution. S. M. Edmonds and N. Birnbaum (J. Amer. Chem. Soc., 1940, **62**, 2367—2369).—At 25° the aq. solubility of $Pb(IO_3)_2$ is $3{\cdot}58 \times 10^{-5}$ mol. per l. The solubility of $Pb(IO_3)_2$ in solutions of NH_4OAc and NH_4ClO_4 of unit ionic strength has been measured and the data support the view that $Pb(OAc)^{\cdot}$ ions are formed (cf. Sandved, A., 1928, 131). Vals. of the equilibrium const. have been computed. W. R. A.

Activation of carbon with salts. N. F. Jermolenko and Rozova (Kolloid. Shurn., 1938, **4**, 429—437).—The adsorptive power for I, AcOH, and methylene-blue in aq. solution of C obtained by impregnating pine sawdust with aq. solutions of salts and carbonising at various temp. has been measured. Activation is due principally to gaseous products of decomp. of the salts, and the formation of a layer of salt protecting the surface of the C from tarry substances plays no part. There is some activation even when the temp. of carbonisation is below the m.p. of the salt, supposedly due to a loosening of the tarry crust by the salt. There is evidence that with rise in the temp. of carbonisation the surface area accessible to large adsorbate mols. increases but at the same time the ultra-porosity falls. C superior in adsorbent power to technical activated C has been prepared. R. C.

Synthesis of paraffins. I. Activated adsorption of hydrogen, carbon monoxide, carbon dioxide, and water on cobalt. II. On iron. S. Matsumura, K. Tarama, and S. Kodama (J. Soc. Chem. Ind. Japan, 1940, **43**, 175—179B, 179—181B).—I. Activated adsorption of H_2, CO, CO_2, and H_2O on Co begins at 60°, 60°, 100°, and 30°, and max. vals. are attained at 200°, >200°, 150°, and 100°, respectively. The adsorption of H_2 is low below 160°. Chemisorption of CO leads to the formation of Co_2C.

II. Activated adsorption of H_2 on Fe begins at 60°, and reaches a max. at 190°, but much higher temp. are required for the activated adsorption of the other gases. W. A. R.

Theory of adsorption on square lattices. J. K. Roberts (Nature, 1940, **146**, 372—374).—A reply to criticism (A., 1940, I, 355). L. S. T.

Dielectric constant of water adsorbed on powdered quartz. I. V. Shilenkov (Kolloid. Shurn., 1938, **4**, 473—476).—If the amount adsorbed is small, its dielectric const. is < that of H_2O in the ordinary state. R. C.

Surface tension of aqueous solutions of some paraffin-chain colloidal electrolytes, including a comparison of the capillary rise and sessile bubble methods of measurements. H. V. Tartar, V. Sivertz, and R. E. Reitmeier (J. Amer. Chem. Soc., 1940, **62**, 2375—2380).—For certain paraffin-chain colloidal electrolytes, the γ of which changes with surface ageing, vals. of γ obtained by the sessile bubble method are more accurate and reproducible than those obtained by capillary rise. Data are given showing the type of time-change and the final equilibrium vals. of γ of aq. solutions of buffered hydroxyethylammonium laurate, oleate, myristate, and nonoate, Na decyl-, dodecyl-, and tetradecyl-sulphonates, and Na laurate at 40°. W. R. A.

Oiliness of liquids. IX. Static friction coefficients of cyclic compounds for glass surfaces. T. Isemura (Bull. Chem. Soc. Japan, 1940, **15**, 288—291; cf. A., 1939, I, 516).—Static friction coeffs. of 15 cyclic compounds have been determined. Of these, the worst lubricant is decahydronaphthalene ($\mu = 0{\cdot}87$), and the best *m*-cresol (0·66) and *cyclo*hexanol (0·66). A. Li.

Spreading of binary mixtures of volatile organic liquids on water. C. P. Keim and E. R. Washburn (J. Amer. Chem. Soc., 1940, **62**, 2318—2320).—A unimol. film of stearic acid in C_6H_6 was spread on H_2O and compressed by a movable barrier. At a certain film pressure a small drop of one of the following binary mixtures was put on the film and spread spontaneously, causing the unimol. film to exert an increased pressure. The mixtures were: C_6H_6–PhMe, C_6H_6–$PhNO_2$, C_6H_6–*cyclo*hexane, C_6H_6–PhBr, and PhMe–$PhNO_2$. At higher film pressures these mixtures did not spread but formed small thin lenses and the pressure at which this was observed is the max. spreading pressure of the mixture. Straight lines are not obtained on plotting spreading pressures against composition, and, therefore, the γ–composition curves cannot be straight lines. The mixtures C_6H_6–

$PhNO_2$ and PhMe–$PhNO_2$ show close correspondence of behaviour. W. R. A.

Stereochemistry of ultra-dilute solutions. S. BULL (Stereochem., 1938, **2**, 177—179).—Speculative.

Effect of foreign substances on stability of aërosols. L. V. SMIRNOV and V. A. SOLNTZEVA (Kolloid. Shurn., 1938, **4**, 401—406).—H_2O vapour accelerates the settling of NH_4Cl smoke (I), but stabilises a mist of Solar oil (II). *iso*Amyl alcohol stabilises both. PhOH and $PrCO_2H$ have no stabilising action on (I), but stabilise (II) slightly. The stabilising action of foreign substances on aërosols is due either to their serving as condensation nuclei, resulting in a higher initial degree of dispersity, or to the formation on the aërosol particles of adsorbed films which hinder growth. R. C.

Stability of emulsions. III. General survey of solid emulsifying agents with special reference to the hydrous oxides and hydroxides. H. L. BENNISTER, A. KING, and R. K. THOMAS (J.S.C.I., 1940, **59**, 226—232; cf. A., 1940, I, 410).—The emulsifying properties of a no. of insol., inorg. ppts. have been investigated. The hydrous oxides and hydroxides are alone efficient emulsifiers. Emulsifying properties of the hydroxides or oxides of 18 elements are described and shown to vary with physical state as well as chemical constitution. Ageing of such ppts. has considerable influence on emulsifying efficiency. Co-pptn. with gelatin or addition of minute quantities of surface-active compounds increases emulsifying ability.

Viscosity of suspensions in non-aqueous liquids. E. W. J. MARDLES (Trans. Faraday Soc., 1940, **36**, 1007—1017; cf. A., 1940, I, 357).—When the viscosity (η) of suspensions of kaolin, graphite, and various pigments in org. liquids is measured at rates of shear high enough to ensure const. η, the ratio η/η_0 generally increases with the viscosity, η_0, of the dispersion medium; for a given dispersion medium it decreases with rising temp. The anomalous η observed at lower rates of shear is less marked with liquids of high than with those of low η_0. Agreement with Einstein's equation at low concns. is not generally found, the val. of the const. reaching 10 for kaolin in PhMe. Abnormally high vals. of η are attributed to disturbance of laminar flow by the precessional movement and mutual interference of the particles, alone or in aggregates. Differences in behaviour depending on η_0 are ascribed to the slower rotational movement in the more viscous liquids. F. L. U.

Development of structure in dilute ferric hydroxide sols. C. M. PITTEL and A. J. RABINERSON (Kolloid. Shurn., 1938, **4**, 461—472).—Dil. sols containing $\nless 0{\cdot}5\%$ Fe_2O_3 undergo thixotropic gelatinisation on adding electrolytes with or without heating in the same way as more conc. sols. On inversion of a vessel containing such a gel intermicellar liquid gradually escapes. It is inferred that gelatinisation does not depend in this case on high hydration but on the formation of oriented links between markedly anisodiametrical particles. η of dil. sols containing electrolytes indicates thixotropic structure formation, succeeded after a time by signs of thixolability. On boiling dil. dialysed sols changes occur similar to but much less pronounced than those observed with more conc. sols (A., 1935, 1073), owing to increased hydrolysis of the salts in the intermicellar solution. Boiling dialysed sols containing coagulating electrolyte accelerates structure formation as a result of increasing probability of collision and adhesion. It is concluded that structure formation in dil. sols proceeds in the same way as in more conc. sols, but is far less pronounced. R. C.

Optical phenomena with suspensions of potato starch in benzene. V. I. NAZAROV (Kolloid. Shurn., 1938, **4**, 439—441).—When such suspensions are illuminated from the side they show a colour which depends on the amount of H_2O in the starch. R. C.

Effect of salts on viscosity of sols of lyophilic colloids. V. F. M. SCHEMJAKIN and M. E. KUPERMAN (Kolloid. Shurn., 1938, **4**, 363—368; cf. A., 1933, 779).—The effect of $COMe_2$ solutions of salts on the η of $COMe_2$ solutions of cellulose acetate is similar to the effect observed with aq. solutions. The η–salt concn. curves exhibit several max. and min., the appearance of which is attributed to the salting out and gelatinising action of the salts, and the enveloping of ions by micelles. R. C.

Clay–water relationships. H. H. MACEY (Proc. Physical Soc., 1940, **52**, 625—655).—Data for a no. of types of clay show that, if the plastic clay–H_2O mixture is subjected to a steady pressure between porous pistons, then $P = \alpha e^{-\beta M}$ and $C = \theta e^{\phi M}$, where P is the applied pressure, M the equilibrium moisture content, and C the aq. conductivity. A comparison of experimental and calc. moisture content distributions in clay bars, drying from one end only, confirms the assumption that the H_2O movement during drying is associated with P and the validity of the extrapolation of the formulæ for P and C to moisture contents below those possible experimentally. The variation in C cannot be explained if η of the H_2O in the mixture is the same as that in bulk, and data indicate an anomalous η, very large at the solid–liquid interface and decreasing exponentially with distance from the interface. This is attributed to an intensity of crystal structure in the H_2O which decreases from the interface in a similar manner. N. M. B.

Oil–soap jellies. S. BULL (Stereochem., 1938, **2**, 71—75, 80).—Speculative.

Behaviour of cellulose in alkaline solutions.—See B., 1940, 785.

Highly oriented cellulose preparations.—See B., 1940, 785.

Electrochemical properties of lyophilic colloids. I. Electrometric determination of electrochemical equivalent and isoelectric point of gelatin fractions. S. M. LIEPATOV and I. I. SOKOLOV. **II. Effect of temperature and dilution on electrical conductivity of gelatin fractions.** I. I. SOKOLOV and S. M. LIEPATOV. **III. Mobilities of ions of gelatin fractions.** I. I. SOKOLOV (Kolloid. Shurn., 1938, **4**, 301—308, 309—318, 319—

326).—I. Determination of the equiv. of sol. and insol. gelatin (I) fractions by conductometric and potentiometric titration has shown their chemical identity. Isoelectric points have been determined.

II. With the disaggregation of (I) there is no increase in the no. of ionogenic groups; thermolysis involves chiefly the rupture of secondary valencies. The temp. coeffs. of the conductivities of the various fractions differ little. The dissociation consts. of the thermolysed and insol. fractions have been determined. Probably the fractions are more active chemically than (I) itself.

III. Ionic mobilities have been calc. from conductivity data and measurements of diffusion potentials. The mobility of the ion of unfractionated (I) and that of the ion of the insol. fraction are ~20, whilst that of the thermolysed fraction is ~24 (cf. A., 1932, 467). These ions are univalent, and the equiv. wt. determined by titration of the NH_2 groups leads to a val. of ~1100 for the mol. wt. R. C.

Lyophilic colloids. XVI. Ageing and gelatinisation of lyophilic colloids. S. M. Liepatov and L. V. Petrovskaja (Kolloid. Shurn., 1938, **4**, 327—335).—In the ageing of gelatin sols the structural η increases much more than the true η, indicating a consolidation of the internal structure. Gelatinisation is retarded by the presence of fractions of a low degree of aggregation. The η of a sol obtained by melting an aged gel or of an aged sol is < that of a fresh sol. The sol. fraction depresses η because it destroys the internal structure of the sol and reduces the amount of osmotically imbibed liquid. It is suggested that with fall in temp. the degree of dispersity of a sol diminishes, which is accompanied by immobilisation of part of the liquid and gelatinisation. R. C.

Modification of colloidal characteristics of rubber latex.—See B., 1940, 811.

Solvation of colloids in organic solvents. A. V. Dumanski and T. A. Granskaja (Kolloid. Shurn., 1938, **4**, 291—299).—The sorption of $PhNO_2$ from solution in EtOH by synthetic rubber and of C_6H_6 and PhMe from solution in EtOH by cellulose acetate (I) has been measured. The amounts sorbed fall with the concn. Bradley's equation (A., 1936, 1457) represents the sorption by (I) satisfactorily except at the lower concns. R. C.

Rubber as a polyaggregate system. V. Margaritov (Kolloid. Shurn., 1938, **4**, 449—454).—A crit. review of the literature shows that rubber exhibits many of the properties of liquid crystals, and that its elasticity partly depends on the mobility of the aggregation equilibria within it (cf. A., 1938, I, 618). R. C.

Kinetics of crystallisation of rubber gels. V. B. Margaritov [with L. K. Serebrianikova] (Kolloid. Shurn., 1938, **4**, 443—447).—The rate of elastic–plastic flow is used as a criterion of the power of rubber to crystallise. The properties of frozen rubber depend on the duration and well as the temp. of cooling; prolonged cooling at a particular temp. may have the same effect as brief cooling at a lower temp. Hydrocarbons and surface-active substances inhibit crystallisation. R. C.

Refraction of periodic precipitates of silver dichromate in stretched gelatin. C. A. Tschertsches (Kolloid. Shurn., 1938, **4**, 407—412).—For $Ag_2Cr_2O_7$ rings in gelatin n at the boundary between normal and stretched gelatin in the field of diffusion falls linearly with increase in the amount of stretching. The const. of periodicity behaves similarly. R. C.

Effect of capillarity on periodicity constant. A. P. Runtzo (Kolloid. Shurn., 1938, **4**, 413—416).—For the reaction $Na_2HPO_4 + MnCl_2 = MnHPO_4 + 2NaCl$ carried out in a wedge-shaped capillary, the const. of periodicity increases linearly with the width of the capillary. In periodic reactions carried out under these conditions the distance between successive rings passes through a max. with increase in the distance from the point at which the reactants meet. R. C.

Periodic layers. P. F. Michalev (Kolloid. Shurn., 1938, **4**, 373—376; cf. A., 1938, I, 248).—The formation of such layers has been observed in the condensation of H_2O vapour, the crystallisation of $CuSO_4$ on filter-paper, the evaporation of mixed solutions of Zn, Cd, and Sn salts, and the crystallisation of aq. solutions of $CuCl_2$ and $NiSO_4$. R. C.

Electrophoresis of hydrocarbons and aliphatic esters as a function of p_H. G. C. Williams (Trans. Faraday Soc., 1940, **36**, 1042—1053).—Electrophoretic mobilities (u) of $C_{12}H_{26}$, $C_{18}H_{38}$, and several aliphatic esters were measured over the p_H range 2—12 in presence of 0·01N-$Na^{\cdot}$. The u–p_H curves for the solid substances are depressed below those for the corresponding liquids, especially at p_H >7, to an extent not accounted for by the change of η with temp. Curves for liquids at temp. only slightly above the m.p. resemble the curve typical of solids more closely than that typical of liquids >5° above the m.p. It is suggested that an intermediate cybotactic state is involved. The esters fall into three groups giving distinct types of curve, the interpretation of which is discussed. F. L. U.

Convection effects in electrophoresis. C. Alvarez-Tostado (J. Biol. Chem., 1940, **135**, 799—800).—Using the Tiselius apparatus, it is found that for freedom from convection disturbances of the boundaries due to 0·5% sucrose in buffers of p_H 7·5, 7·3, and 6·9 it is safe to use 8 w. for runs of 4—5 hr. duration and 6 w. for all ordinary purposes. H. G. R.

Electrolytic dissociation in sulphuric acid as studied by Raman effect. N. R. Rao (Indian J. Physics, 1940, **14**, 143—151).—The Raman spectra of aq. H_2SO_4 have been examined, and from the variation in intensity of the displacements 910, 980, and 1043 cm.$^{-1}$, the % dissociation of H_2SO_4 is computed. W. R. A.

Acidity scale in glacial acetic acid. I. Sulphuric acid solutions $-6 < H_0 < 0$. N. F. Hall and W. F. Spengeman. **II. Buffer solutions $-1{\cdot}6 < H_0 < 3{\cdot}8$.** N. F. Hall and F. Meyer (J. Amer. Chem. Soc., 1940, **62**, 2487—2492, 2493—2500).—I. The acidity (H_0) of H_2SO_4 solutions in glacial AcOH from 0·003 to 8·0M. with the indicators 1 : 4 : 2-NH_2·C_6H_3Cl·NO_2 (I), 1 : 2 : 4 : 6-NH_2·$C_6H_2Cl_2$·NO_2, 1 : 4 : 2 : 6-NH_2·$C_6H_2Me(NO_2)_2$, and

1 : 2 : 4 : 6-$NMe_2 \cdot C_6H_2(NO_3)_3$ at 23°, using the visual colorimetric method, has been investigated. H_0 vals. of aq. H_2SO_4 over the same concn. range have also been determined. Vals. of indicator const. (pK) at 25° have been computed taking the pK val. of (I) as −0·91 and are compared with recorded data.

II. The acidity of 0·1M-$CO(NH_2)_2$–H_2SO_4 solutions and antipyrine–H_2SO_4 solutions in glacial AcOH with the indicators *o*- (II) and *p*-$NH_2 \cdot C_6H_4 \cdot NO_2$, *m*- and *p*-$NMe_2 \cdot C_6H_4 \cdot NO_2$, and -$NEt_2 \cdot C_6H_4 \cdot NO_2$ have been measured by a photelometer at 25°. pK vals., based on pK of (II) as −0·17, and H_0 vals. have been calc. and compared with existing data. W. R. A.

Calculation of composition of phases in equilibrium. G. SCATCHARD (J. Amer. Chem. Soc., 1940, **62**, 2426—2429).—The compositions of two phases of a binary system which are in equilibrium may be determined by plotting, for each phase, the activity of one component against the activity of the other with the same standard for each state of aggregation. The two curves will intersect at equilibrium. The method is applied to several types of system. W. R. A.

Phase equilibria in hydrocarbon systems. XXXII. Methane–*n*-butane system in the gaseous and liquid regions. B. H. SAGE, R. A. BUDENHOLZER, and W. N. LACEY (Ind. Eng. Chem., 1940, **32**, 1262—1277).—A study of the system CH_4–*n*-C_4H_{10} over the range 70—250° and at pressures up to 3000 lb. per sq. in. has been made, and the data are presented in tabular and graphical form. From these data the partial vol. behaviour of both components has been calc. throughout the single-phase region at 30° intervals over the whole temp. range. The partial enthalpy and fugacity of the components have been calc. as functions of state for the greater part of the gaseous region. The partial thermodynamic behaviour of both components in both phases is tabulated. C. R. H.

Existence of carbamate ion in reaction of ammonia–soda process.—See B., 1940, 794.

Equilibrium solid solutions in ionic lattices. Systems $KMnO_4$–$KClO_4$–H_2O and NH_4Cl–$MnCl_2$–H_2O. A. L. GREENBERG and G. H. WALDEN, jun. (J. Chem. Physics, 1940, **8**, 645—658).—The system $KMnO_4$–$KClO_4$–H_2O yields a continuous series of solid solutions with orthorhombic crystal symmetry. Vegard's additivity law holds for the a_0 and c_0 lattice consts. but the b_0 const. shows a definite deviation. The system NH_4Cl–$MnCl_2$–H_2O contains three series of solid solutions, one having cubic symmetry and the others tetragonal symmetry. Vegard's law is not followed. The *compound* $6NH_4Cl,MnCl_2,2H_2O$ is shown to exist, whilst the existence of $2NH_4Cl,MnCl_2,2H_2O$ is confirmed. These compounds, regarded as "compounds of variable composition," are tetragonal with a_0 15·256±0·004, c_0 16·008±0·007, and a_0 7·5139±0·0005, c_0 8·245±0·003 A., respectively. J. W. S.

Heats of dissolution of alkali halides and of hydrogen chloride in water–methyl alcohol solutions at 25°. C. M. SLANSKY (J. Amer. Chem. Soc., 1940, **62**, 2430—2434).—Using a differential adiabatic calorimeter (described) the heats of dissolution at infinite dilution have been measured at 25° for HCl, LiCl, NaCl, KCl, RbCl, CsCl, NaBr, KBr, NaI, and KI in various mixtures of MeOH and H_2O. For each compound the max. heat absorption occurred in solutions containing ~15 mol.-% of MeOH, and more heat was evolved on dissolution in MeOH than in H_2O. W. R. A.

Heat of dissolution of gadolinium sulphate octahydrate and entropy of the gadolinium ion. L. V. COULTER and W. M. LATIMER (J. Amer. Chem. Soc., 1940, **62**, 2557—2558).—The heat of dissolution of $Gd_2(SO_4)_3,8H_2O$ at 25° is −6710±100 g.-cal. per mol.; the free energy of a 1M. solution, the entropy at 25° of the solution, and the entropy of the $Gd^{\cdots}$ ion have been computed. W. R. A.

Heat of dilution of aqueous sodium hydroxide solutions at 25°. J. M. STURTEVANT (J. Amer. Chem. Soc., 1940, **62**, 2276—2280).—The integral heats of dilution of aq. NaOH (up to ~4·2M.) have been determined at 25° using the apparatus previously described (A., 1940, I, 218) and from the data the apparent and partial relative mol. heat contents of the solute and solvent have been calc. and are compared with existing data. W. R. A.

Thermodynamics of the silver bromide–mercurous bromide cell. T. W. DAKIN and D. T. EWING (J. Amer. Chem. Soc., 1940, **62**, 2280—2284).—The standard electrode potential ($E°$) of Hg_2Br_2 has been measured by reference to the AgBr standard electrode potential at 5° intervals from 15° to 35° using cells of the types $Hg|Hg_2Br_2$, aq. HBr (xM.), $AgBr|Ag$ (x = 0·05, 0·10, 0·20), and $Hg|Hg_2Br_2$, KBr, $AgBr|Ag$. At 25° $E°$ = 0·13925 v.; the energy, heat, and entropy of formation of Hg_2Br_2 are respectively −42,733, −48,776 g.-cal. per mol. and −20·4 g.-cal. per degree per mol. The various vals. are compared with recorded data. W. R. A.

Metallised glass oxygen electrodes. H. G. BAIN (Trans. Electrochem. Soc., 1940, **78**, Preprint 16, 211—227).—The behaviour as O_2 electrodes of the Pt metals deposited on glass both in the bright and black conditions, and immersed in electrolytes containing respectively H_2SO_4, KCl, and NaOH, has been examined. Although black deposits of Os on a bright Pt base on glass gave fairly reproducible results, in no instance was the reproducible and const. theoretical val. for the O_2 potential obtained. The phenomenon of motor electrolytic potential which is characteristic of these electrodes has been studied, and is considered to have a marked influence on their observed behaviour. J. W. C.

Deposition potentials of metals from fused alkali chloride–aluminium chloride baths. W. H. WADE, G. O. TWELLMEYER, and L. F. YNTEMA (Trans. Electrochem. Soc., 1940, **78**, Preprint 17, 229—242).—Using a Pt reference electrode together with a C anode and Pt cathode, the cathodic deposition potentials of H_2 and of six common metals dissolved as chloride in a fused bath containing NaCl, KCl, and $AlCl_3$ have been determined. With the exception of Cu, which is ~0·3 v. less noble than H_2, the order of deposition potential corresponds with that found for deposition from aq. N-sulphate solutions of the

respective metals, ranging from $-1\cdot15$ v. for Co to $-2\cdot02$ v. for Al for smooth, bright deposits. At higher potentials the fused salt bath produces dendritic or grey deposits. J. W. C.

Electrochemical potential differences at the boundary copper–insulating liquids. A. GEMANT (Trans. Electrochem. Soc., 1940, **78**, Preprint 21, 297—309).—A no. of e.m.f. measurements have been made on systems of the type Cu|insulating solvent| insulating solvent + Cu oleate or acetate|Cu. With kerosene–benzole and –xylene mixtures the electrode in Cu oleate systems shows a negative e.m.f. If the conductivity of the insulating solvent is increased, *e.g.*, by addition of EtOH, the e.m.f. becomes positive. Similarly, addition of EtOH to xylene changes the potential in Cu acetate systems from negative to positive. By measuring one insulating liquid against another a series has been established arranged according to the electrolytic solution pressure of Cu in the respective liquid phases. C. R. H.

Hydrogen anode. M. DE K. THOMPSON and H. V. FAIRBANKS (Trans. Electrochem. Soc., 1940, **78**, Preprint 23, 327—335).—The current efficiency of H_2 anodes, prepared by bubbling H_2 through porous C containing Pt deposited either on the surface or in the pores, when electrolysed in dil. HCl is $\sim$100% for c.d. $\not>1\cdot5$ amp. per sq. dm. and for high H_2 flow rates. This efficiency has been maintained for 8 hr. The current efficiency of $CuCl_2$ and $NiCl_2$ solutions is $\ll$100%. CuCN poisons the anode. C. R. H.

Oxidation–reduction potentials measured with the dropping mercury electrode. III. Polarographic study of quinhydrone in buffered and unbuffered solutions. O. H. MÜLLER (J. Amer. Chem. Soc., 1940, **62**, 2434—2441).—Polarograms of $0\cdot0012$M-quinhydrone (I) solutions in PO_4''' buffer of p_H 6·9 with indifferent electrolyte $0\cdot1$N-KNO_3, of unbuffered solutions of (I) (up to $0\cdot001$M.) in $0\cdot1$N-KNO_3, and of $0\cdot001$M. solutions of (I) in $0\cdot01$M-CO_3'' buffer at p_H 7·5, measured by the dropping Hg electrode, are given and discussed. For the oxidation of quinol and the reduction of benzoquinone, marked changes in the interfacial p_H occur and, except with the carbonate buffer, may be prevented by buffering, the efficacy of which depends on the relative concns. of buffer and reacting material. Adequate solution buffering requires (i) a buffer 100 times the concn. of the reacting material, (ii) a buffer the acid and salt components of which dissociate and associate without added energy of activation, and (iii) a buffer in which the acid and salt concn. are approx. equal. For inadequate buffering the half wave potential is not const. with changing reacting material concn. or changing drop time, the interfacial p_H being unknown. Measurements in phthalate, citrate, and OAc' buffers show perfect buffer action in proper concn., whilst the addition of aq. NH_3 to NH_4Cl buffer solution improves buffer action. W. R. A.

Exchange reaction between hydrogen and hydrogen iodide. H. STEINER (Trans. Faraday Soc., 1940, **36**, 1111—1113).—The exchange reaction p-H_2 + HI = o-H_2 + HI is proposed to account for the additional conversion of para- into ortho-H_2 studied by Rosenbaum and Hogness (A., 1934, 847). This mechanism is in agreement with the available experimental data. F. L. U.

Rôle of heat conduction in thermal gaseous explosions. O. K. RICE (J. Chem. Physics, 1940, **8**, 727—733).—Frank-Kamenetzky's theory of thermal explosions in which heat is removed by conduction only (A., 1939, I, 614) is applied to various explosive reactions. It is concluded that in the explosions of CH_2N_2 and EtN_3 thermal conduction is an important, if not the exclusive, means of heat removal at low pressures, but that deviations appear at high pressures. The explosion of $MeNO_3$ is probably not a thermal explosion. Frank-Kamenetzky's criticisms (A., 1940, I, 165) of the determination of heat of reaction from the induction period (A., 1939, I, 568) are refuted. J. W. S.

Spark ignition of mixtures of *as*-dimethylhydrazine and nitric oxide. D. A. BAMFORD and C. H. BAMFORD (Trans. Faraday Soc., 1940, **36**, 1036—1042).—The explosion of $NMe_2{\cdot}NH_2$–NO mixtures is thermal in origin, and is due to heating of the system by highly exothermal reactions between radicals and NO. A mechanism is proposed. F. L. U.

Isotopic exchange reactions of organic compounds. V. Kinetics of isomerisation and deuterium exchange reaction of Δ^{α}-pentenoic acid. D. J. G. IVES and R. H. KERLOGUE (J.C.S., 1940, 1362—1370).—A reaction mechanism involving β-hydroxyvaleric, Δ^{α}- (I) and Δ^{β}-pentenoic acids, each in direct equilibrium with the other two, is suggested in explanation of data for the alkali-catalysed isomerisation of (I) in H_2O. Isomerisation proceeds mainly by direct prototropic change and to a smaller extent ($\sim$4% at half-change) by addition and fission of H_2O. The results of a study of the D_2 exchange reaction which accompanies isomerisation in a "heavy" medium conform with this mechanism. C. R. H.

Kinetics of saponification of methyl acetate in dioxan–water mixtures at 25°. T. C. HUANG and H. S. HSIEH (J. Chinese Chem. Soc., 1939, **7**, 1—13). —The speed of hydrolysis of $0\cdot01$N-MeOAc by $0\cdot01$N-NaOH was measured by the conductivity method at 25° in dioxan–H_2O mixtures, in which the wt. of dioxan varies from 0 to 30%; mixtures containing >40% of dioxan give erratic results. The bimol. velocity coeff. increases linearly with the mol. fraction of dioxan in the solvent mixture. Apparatus is described. A. T. P.

Kinetics of formation of lead titanate. A. V. PAMFILOV and K. S. FRIDMAN (J. Gen. Chem. Russ., 1940, **10**, 210—212).—The velocity of reaction of the rhomboid is > that of the tetragonal modification of PbO at <488·4°, but at higher temp. the reverse is the case. R. T.

Rate of decomposition of cyanite at various temperatures.—See B., 1940, 797.

Mutarotation of *d*-glucose in absolute methanol. H. H. ROWLEY and S. D. BAILEY (J. Amer. Chem. Soc., 1940, **62**, 2562—2563).—The rate of mutarotation of α-, $[\alpha]_D$ $+115\cdot5\pm0\cdot5° \rightarrow 66\cdot5\pm0\cdot3°$ in

MeOH, and β-*d*-glucose, $[\alpha]_D$ $+17{\cdot}0\pm0{\cdot}5°$ in MeOH, in abs. MeOH at 35—45° indicates presence of only two forms. The activation energy, ~15,000 kg.-cal., indicates a mode of reaction similar to that in H_2O.
R. S. C.

Mutarotation of α-*d*-glucose in ethanol–water mixtures at 25°. H. H. ROWLEY (J. Amer. Chem. Soc., 1940, **62**, 2563—2565).—Mutarotation of α-*d*-glucose, $[\alpha]_D$ $+65{\cdot}5° \rightarrow +116{\cdot}2°$ in abs. EtOH, in aq. EtOH is accurately a first-order reaction.
R. S. C.

Polymerisation of water and mutarotation of glucose. H. WELSCH (Bull. Soc. Roy. Sci. Liége, 1939, 57—66).—The rates of mutarotation of glucose (I) in aq. solution and in nearly saturated solutions of some inorg. salts are determined. With nearly saturated LiCl, if account is taken of the η of the solution and the amount of H_2O at the disposal of the (I), the rate is > 4 times as great as that in aq. solution. This agrees with the hypothesis of Lowry and Smith; the LiCl increases the no. of H_2O mols. liberated by depolymerisation. Addition of gelatin to aq. solutions of (I) does not increase the rate of mutarotation. Gelose has a similar effect, although there may be a slight depolymerisation of H_2O.
J. N. A.

Kinetics of mutarotation of hydroxymethylene-*d*-camphor. II. B. K. SINGH and M. K. SRINIVASAN (Proc. Indian Acad. Sci., 1940, **12**, **A**, 21—29).—The catalytic influence of moisture on the temp. coeff. of the velocity coeff., k, of the mutarotation, $[\alpha]$, of hydroxymethylene-*d*-camphor in C_6H_6 is discussed. Corresponding vals. of k and $[\alpha]$ at 25°, 35°, and 45° are given for different drying intervals and a mechanism of the mutarotation is suggested. W. R. A.

Para-hydrogen conversion on tungsten. D. D. ELEY and E. K. RIDEAL (Nature, 1940, **146**, 401—402).—An experiment indicating that the p-H_2 conversion occurs by a surface interchange reaction of the type $p\text{-}H_2 + WH = o\text{-}H_2 + HW$ is described.
L. S. T.

Effect of metals on the addition of hydrogen bromide to allyl bromide.—See A., 1940, II, 362.

Catalytic isotope exchange of gaseous oxygen. X. Exchange of oxygen atoms between oxygen and water vapour on the surface of aluminium oxide. Influence of the composition of the gas mixture on the rate of exchange. N. MORITA (Bull. Chem. Soc. Japan, 1940, **15**, 298—308; cf. A., 1940, I, 392).—The rate of exchange of O between O_2 and H_2O vapour in presence of Al_2O_3 has been determined, varying the temp. (390—700°) and the ratio $O_2 : H_2O$. The reaction becomes appreciable at 520°, and rapidly reaches equilibrium at 700°, but the rate is almost independent of the $O_2 : H_2O$ ratio, showing that the determining factor is activated adsorption of H_2O on the Al_2O_3. The theory of the exchange is discussed, and the energy of activation calc. as 18—22 kg.-cal. A. LI.

[Catalytic] synthesis of acetic acid at high pressures.—See B., 1940, 777.

Dehydrogenation of borneol and *iso*borneol, using activated nickel catalyst.—See B., 1940, 778.

Reduction of aldoses at the dropping mercury cathode.—See A., 1940, II, 364.

Chemical reaction in electric discharges. III. The meaning of Φ, the electrochemical analogue of the photochemical quantum yield, and factors controlling Φ in the stationary state. R. W. LUNT and G. E. SWINDELL. **IV. Negative glow reaction in hydrogen–oxygen mixtures.** R. W. LUNT, T. G. PEARSON, and B. TOPLEY (Trans. Faraday Soc., 1940, **36**, 1072—1087, 1087—1110).—III. Φ, the no. of mols. of a reaction product formed per electron-reactant collision generating the active species that initiates reaction, is used to relate the rate of such collisions to the rate of formation of the observed product. The only factor controlling Φ that usually depends on experimental conditions is the fractional utilisation of the active species, which can be deduced from its fractional concn. Expressions for the relation of the latter to experimental conditions and the rate of the relevant electron–reactant collisions are derived.

IV. Quant. data for the oxidation of H in the negative glow reaction in H_2–O_2 mixtures are collected, recalc., co-ordinated, and critically reviewed. The main features of the reaction find a detailed explanation in terms of the general theory given previously (cf. A., 1937, I, 2) and of particular reaction mechanisms involving O and H atoms as the active species. F. L. U.

Action of electrons and *X*-rays on photographic emulsions. A. CHARLESBY (Proc. Physical Soc., 1940, **52**, 657—700).—The measurement of electron densities by means of their photographic effect is examined, and available data on the photographic action of light photons, *X*-ray photons, and electrons are summarised. Similarity between high-velocity electrons and *X*-ray photons and between low-velocity electrons and light photons, and the effect of a gradual increase in the energy of the incident particle on the shape of the blackening curve, are discussed. A theory based on an exponential decrease in the effect of the electrons due to absorption in the emulsion is advanced, and the resultant formula depends simply on the grain properties of the emulsion and on the absorption of the beam within it. An extension to variation with grain size is given, and the effect of varying absorption on the shape of the blackening curve is investigated. Comparison of the formula with available experimental data allows many of the grain properties of the emulsion, shape of the blackening curve, and the range of the emulsion to be predicted. The apparent independence of the shape of the characteristic curve for *X*-rays of the λ is deduced and observed variations are accounted for.
N. M. B.

Time course of photosynthesis and fluorescence. Photosynthesis of *Chlorella*.—See A., 1940, III, 871.

Report of the Committee for the reform of inorganic chemical nomenclature, 1940. W. P. JORISSEN, H. BASSETT, A. DAMIENS, F. FICHTER, and H. REMY (J.C.S., 1940, 1404—1415).—Rules for naming inorg. compounds which aim at a uniform system and advise the discontinuance of out of date and

incorrect names are proposed. The more important recommendations are as follows. Valency indication by terminations such as -ous, -ic should be avoided and Stock's method used, *e.g.*, FeO = iron(II) oxide. Intermetallic compounds are best denoted by formulæ and where the composition is not const. ("non-Daltonian" compounds) a bar is placed over the formula, *e.g.*, $\overline{AuZn}$ for the β-phase in the system Au–Zn. The term "halogenide" is preferred to "halide" and the terms "chalkogen" and "chalkogenide" are suggested for O, S, Se, and Te and their compounds. Recommended names for oxy-acids and salts of S, N, P, and B generally conform to modern usage but dithionous, peroxymonosulphuric, nitroxylic, and tetraboric acids are preferred to hydro(or hypo)sulphurous, persulphuric, hydronitrous, and pyroboric acids respectively. Hydronium replaces hydroxonium ion for $[H_3O]^+$. Stock's method of indicating valency is applied to Werner's nomenclature for co-ordination compounds. Recommendations for the nomenclature of higher-order compounds., *e.g.*, iso- and hetero-poly-acids, are also made and illustrated. C. R. H.

Preparation of magnesium by reduction with calcium carbide. IV, V.—See B., 1940, 802.

Production of air-free carbon dioxide. C. PEPIN (Document. sci., 1937, **6**, 84—85; Chem. Zentr., 1937, i, 4993).—A device for transferring boiled-out HCl to a Kipp's apparatus in a vac. is described. A. J. E. W.

Compounds of lead halides with organic salts. A. C. VOURNAZOS (Praktika, 1936, **11**, 481—487; Chem. Zentr., 1937, i, 4915—4916).—Additive *compounds* containing one mol. of a Pb halide or $Pb(CN)_2$ with 1, 2, 4, or 8 mols. of an alkali salt of a fatty acid, or of a salt of an org. base with a fatty or aromatic acid, have been obtained from solutions of the components in MeOH, MeOH–$COMe_2$, or H_2O. If direct addition does not occur such compounds may be prepared by double decomp. reactions. A. J. E. W.

Reaction between iron and water in absence of oxygen. M. DE K. THOMPSON (Trans. Electrochem. Soc., 1940, **78**, Preprint 24, 337—341).—The corrosion of reduced Fe powder in O_2-free H_2O to magnetite is confirmed and is shown to be in accordance with $Fe + H_2O \rightarrow Fe(OH)_2 + H_2$. C. R. H.

Anhydrous analogues of iron alums. N. V. SCHISCHKIN (J. Gen. Chem. Russ., 1940, **10**, 271—273).—Cryst. salts of the type $MFe(SO_4)_2$ (M = Na, K, NH_4) are obtained by heating saturated solutions of M_2SO_4 with $Fe_2(SO_4)_3$ in conc. H_2SO_4. R. T.

Calculation of titratable acidity from the total hydrogen ion content. P. S. SHELEZKOV (J. Gen. Chem. Russ., 1940, **10**, 217—218).—The conception of titratable acidity, $S_H = a/10$, where a is the no. of ml. of 0·1N-alkali required to neutralise 100 g. of acid, is introduced. R. T.

Determination of free acid in aluminium sulphate, alum cake, etc.—See B., 1940, 794.

Test for residual chlorine [in water etc.].—See B., 1940, 826.

Micro-determination of bromine in foodstuffs.—See B., 1940, 821.

Amperometric titration of fluorine with thorium nitrate. A. LANGER (Ind. Eng. Chem. [Anal.], 1940, **12**, 511—514).—The titration of F' in dil. solution with $Th(NO_3)_4$, using the dropping Hg electrode for determining the end-point, has been investigated. With 0·01N-$Th(NO_3)_4$, up to 2 mg. of F' can be titrated with a precision of 1·0% in 50 ml. of 0·1M-KCl or -KNO_3 as conducting salt. In smaller vol., 0·005 mg. of F' can be titrated with 0·001N-$Th(NO_3)_4$. The effects of temp., addition of EtOH, and the presence of some common anions are recorded. Similar results can be obtained with $La(NO_3)_3$. Reactions involving the formation of CaF_2, PbClF, FeF_6''', AlF_6''', or ZrF_6'' are unsuitable for amperometric titrations. L. S. T.

Determination of sulphide-sulphur in alkaline solutions containing other sulphur compounds. J. B. LEWIS (Ind. Eng. Chem. [Anal.], 1940, **12**, 535).—Freshly-pptd. $PbSO_3$ is insol. in warm or cold aq. NH_4OAc even in presence of AcOH (cf. A., 1935, 53). No pptn. of $PbSO_3$ by $Pb(OAc)_2$ occurs from alkaline ($\not<$2% of NaOH) solutions. L. S. T.

Conductometric analysis of bisulphite [wood] pulping liquors.—See B., 1940, 787.

Base-exchange media in analytical chemistry. III. Determination of sulphate in presence of various cations. O. SAMUELSON (Svensk Kem. Tidskr., 1940, **52**, 115—125).—$Na^{\cdot}$, $K^{\cdot}$, $Ca^{\cdot\cdot}$, $Al^{\cdot\cdot\cdot}$, $Fe^{\cdot\cdot\cdot}$, and (violet) $Cr^{\cdot\cdot\cdot}$ are replaced with $H^{\cdot}$ in SO_4'' solutions by percolation through a sulphonated org. base-exchange material to reduce absorption errors in SO_4'' gravimetry. (Green) $Cr^{\cdot\cdot\cdot}$ cannot be removed in this way. M. H. M. A.

Preparation of Nessler's reagent. A. P. VANSELOW (Ind. Eng. Chem. [Anal.], 1940, **12**, 516—517).—Factors affecting the performance of Nessler's reagent have been investigated. Increasing [KOH] decreases the amount of excess KI required to prevent pptn. of HgI_2, and accelerates the development of colour with NH_3. 45·5 g. of HgI_2 and 34·9 g. of KI are dissolved in the min. vol. of H_2O, 112 g. of KOH added, and the mixture is diluted to 1 l. This solution is 0·2N. with respect to $Hg^{\cdot\cdot}$. 5 ml. of reagent to 100 ml. final vol. are used, and colour comparisons made 30 min. after mixing. L. S. T.

Detection and elimination of phosphate in qualitative analysis by means of zirconium salts. F. K. PITTMAN (Ind. Eng. Chem. [Anal.], 1940, **12**, 514—515).—A modification of the $ZrOCl_2$ method (cf. A., 1936, 951), in which difficulties due to filtration and to large excesses of reagent are overcome, is detailed. Losses of other metal ions present are not serious. In absence of AsO_4''', C_2O_4'', and $Fe(CN)_6''''$, 1 mg. of PO_4''' in 20 ml. of solution in presence of other anions can be detected readily. Removal of PO_4''' can also be made complete. L. S. T.

Gravimetric determination of phosphate and vanadate. D. T. LEWIS (Analyst, 1940, **65**, 560—561).—P in an org. compound can be determined by

decomp. the sample (0·1—0·4 g.) in a Kjeldahl flask by the method of Lewis and Davis (A., 1939, I, 215) or with fuming HNO_3 and H_2SO_4. The resulting solution is neutralised to Me-red with NH_3, acidified with AcOH, and treated with NH_4OAc (2 g.). The solution is boiled and 0·1N-$UO_2(OAc)_2$ is added dropwise until pptn. is complete. After keeping for some hr. the ppt. is separated and ignited to $(UO_2)_2P_2O_7$. In the determination of VO_3' the solution, containing ~0·05 g. of V_2O_5, is treated with aq. NH_3 until just alkaline to neutral-red screened with methylene-blue, and is then treated in the same way as in the determination of P, the addition of $UO_2(OAc)_2$ yielding a yellow ppt. of *uranyl NH_4 vanadate*, $NH_4(UO_2)VO_4,1·5H_2O$, which is separated and weighed as such. J. W. S.

Analysis of boiler scales and sludges.—See B., 1940, 768.

Oxidation of ammonium oxalate before precipitation of magnesium. A. Steopoe (Ciment şi Beton, 1936, 4, 257—261; Chem. Zentr., 1937, i, 4999).—Oxidation of $(NH_4)_2C_2O_4$ after pptn. of alkaline-earth metals should be effected in a solution containing HNO_3 rather than HCl. After pptn. of CaC_2O_4 the filtrate (350—400 c.c.) is neutralised with conc. HNO_3, of which 2—2·5 c.c. are added in excess, with 15 c.c. of 30% H_2O_2. The solution is then evaporated to 200 c.c. during ≮3 hr. A. J. E. W.

Laboratory uses for surface-active agents. C. M. Alter and D. S. Thomas, jun. (Ind. Eng. Chem. [Anal.], 1940, **12**, 525; cf. A., 1938, I, 586).—The addition of 1 drop of Tergitol 7 (I) to 10 ml. of a suspension of the Mg 8-hydroxyquinoline compound causes the solid to settle completely after slight centrifuging. A similar addition after pptn. and digestion practically eliminates creeping of a ppt. of CaC_2O_4. The life of a AgCl opalescence is increased twenty-fold by the addition of a small amount of (I). L. S. T.

Determination of lead permanganometrically (Low's method). K. Neelakantam (Current Sci., 1940, **9**, 367—368).—In the determination of Pb by pptn. as oxalate from AcOH solution, decomp. of the ppt. with dil. H_2SO_4, and determination of the $H_2C_2O_4$ by $KMnO_4$, it is unnecessary to use 60% AcOH for quant. pptn. of the oxalate, as advocated by Wetherell (B., 1936, 76). HNO_3 cannot be used for dissolution of the PbC_2O_4, as it oxidises the $H_2C_2O_4$. For quant. liberation of $H_2C_2O_4$, HCl is better than H_2SO_4, and can be used in the subsequent titration provided its concn. is ≪N. A. J. M.

Internal electrolysis. V. Determination of small quantities of copper in presence of cadmium. J. G. Fife (Analyst, 1940, **65**, 562—563; cf. A., 1938, I, 583).—Cu is determined by means of the apparatus described previously (A., 1936, 1479) with a Cd tape anode, Pt cathode, anolyte of $CdSO_4$ (containing the equiv. of 5 g. of Cd and 0·2 g. of NH_2OH,H_2SO_4 per 100 ml.), and catholyte (~300 ml.) comprising the solution from which Cu is to be deposited, with the addition of 0·2 g. of NH_2OH,H_2SO_4. Electrolysis is continued for 15—60 min. at 70—80°. J. W. S.

Determination of aluminium, magnesium, or beryllium in nickel alloys.—See B., 1940, 801.

Determination of rhenium in molybdenite minerals. C. F. Hiskey and V. W. Meloche (Ind. Eng. Chem. [Anal.], 1940, **12**, 503—506).—The molybdenite (4 g.) is oxidised by means of conc. + fuming HNO_3, and the excess of HNO_3 removed by repeated evaporation with HCl. Conc. H_2SO_4 is added, and after heating to 260—270°, the Re (+ small amounts of Mo) is distilled in a stream of air + steam. The Re is determined colorimetrically by means of the reaction with CNS′ and $SnCl_2$. Interference by the small amounts of Mo that distil with the Re is prevented by allowing the Mo complex with CNS′ to bleach by keeping for ≮30 min. in presence of conc. HCl. The method is suitable for determining, with moderate accuracy, 5 μg. of Re in presence of a 10^6-fold excess of Mo. Application to 28 molydenite samples is described and data are recorded. L. S. T.

Ceric sulphate in volumetric analysis. J. R. Pound (Chem. Eng. Min. Rev., 1940, **32**, 418—419).—$Fe^{\cdot\cdot}$ can be titrated with $Ce(SO_4)_2$ in dil. H_2SO_4 containing H_3PO_4 using $NHPh_2$ as indicator; oxalic, tartaric, or citric acid does not interfere. For titrating As_2O_3 with $Ce(SO_4)_2$ OsO_4 must be added as catalyst, whilst a small amount of $Fe^{\cdot\cdot\cdot}$ serves as a catalyst in titrating $Sn^{\cdot\cdot}$ in dil. H_2SO_4 solution. A. R. P.

Organic reagents and methods involving their use. Qualitative reactions of salicylaldoxime and its 5-chloro-, 3 : 5-dibromo-, and 5-nitro-derivatives with inorganic ions. J. F. Flagg and N. H. Furman (Ind. Eng. Chem. [Anal.], 1940, **12**, 529—530).—72 inorg. ions have been tested for reaction with these reagents. Positive reactions obtained with 19 ions and each of the reagents are tabulated. $Fe^{\cdot\cdot\cdot}$ gives a blue colour with 5-chlorosalicylaldoxime. Owing to low solubility, the 3 : 5-Br_2-compound is unsuitable for analytical work. The limits of detection of $Cu^{\cdot\cdot}$, $Pb^{\cdot\cdot}$, $Ni^{\cdot\cdot}$, and $Bi^{\cdot\cdot\cdot}$ with salicylaldoxime and its 5-Cl- and 5-NO_2-derivatives are recorded. L. S. T.

[Determination of] antimony in tin-antimony oxides.—See B., 1940, 801.

Analysis of complex platinum ore.—See B., 1940, 802.

Determination of ruthenium by thionalide. Absorption of ruthenium tetroxide with hydrogen peroxide. W. J. Rogers, F. E. Beamish, and D. S. Russell (Ind. Eng. Chem. [Anal.], 1940, **12**, 561—563).—Ru can be pptd. quantitatively from 0·2—0·5N-HCl by means of thionalide (I). Pptn. in HNO_3 solution yields low results. Small amounts of NaCl do not interfere with the pptn. RuO_4 is absorbed quantitatively by cold 3% H_2O_2, and the Ru can be pptd. directly from this solution by means of (I). Low results are obtained when the H_2O_2 contains NHPhAc as a stabiliser. Aq. NaOH can be used as absorbent for RuO_4 and the Ru recovered quantitatively, but the method is long. Gilchrist's method (A., 1934, 622) is untrustworthy with micro-samples. L. S. T.

Measurement of low temperatures. W. H. KEESOM (Comm. Kamerlingh Onnes Lab., 1936, Suppl. 80*a*, 16 pp.; Chem. Zentr., 1937, i, 4072; cf. A., 1936, 180).—The "1936 scale" used in the Onnes laboratory for temp. $>0°$ is defined. The international scale is discussed with reference to its deviations from the thermodynamic scale. The phosphor-bronze resistance thermometer, thermocouples for use at liquid He temp., and temp. measurement at $<1°$ K. are also discussed. A. J. E. W.

Construction of very sensitive vacuum thermo-electric cells. F. T. ROGERS, jun. (Rev. Sci. Instr., 1940, **11**, 281—282).—A simple soldering process for the construction of small thermocouples of the sensitivity necessary for astrophysical work, and a reliable method for enclosing the couples in glass vessels which can be permanently evacuated, are described. A. J. M.

Recording optical manometer for transient pressures. P. B. SMITH (J. Sci. Instr., 1940, **17**, 242—245).—The arrangement described records pressures up to 150 lb. per sq. in. produced by the explosion of gases in closed or partly closed vessels. L. S. T.

Properties and uses of sheet polarising media. S. RÖSCH (Fortschr. Min., 1937, **21**, 89—90; Chem. Zentr., 4995).—The Zeiss "Herotarfilter" and the Land polarising film contain sulphato-periodides of quinine and $[Co(NH_3)_5Cl]^{••}$, respectively. The former uses single crystals, but in the latter submicroscopic crystals are electrically or magnetically oriented in a cellulose emulsion. The optical properties and uses of the filters are described. A. J. E. W.

New refractometers employing diamond and other minerals. B. W. ANDERSON, C. J. PAYNE, and J. PIKE (Min. Mag., 1940, **25**, 579—583).—Replacing the usual glass hemisphere by a prism of diamond (n_D 2·4190, d_4^{15} 3·519) or Zn-blende gives the instrument a wider range for the testing of faceted gemstones. With a prism of colourless artificial spinel (n_D 1·7266, d_4^{15} 3·625) the lower dispersion ($C - F$ 0·0110) enables the instrument to be used in white light, though with a more limited range. A list is given of liquids of high n (up to 2·06) for use with these instruments. L. J. S.

Universal *X*-ray camera for structural analysis. K. F. GUSEEV (Kolloid. Shurn., 1938, **4**, 377—380).—A camera by means of which all the types of *X*-ray diagram can be obtained is described. R. C.

Electrodes sealed in glass tubing. W. C. VOSBURGH (Science, 1940, **92**, 198).—Immersion of a Pt–glass interface does not lead invariably to erratic results (cf. A., 1940, I, 375). L. S. T.

Electrometer valve for laboratory and industrial use. L. SUTHERLIN and R. H. CHERRY (Trans. Electrochem. Soc., 1940, **78**, Preprint 26, 351—360).—The construction of the valve (Westinghouse RH–507) is described. With it potentials in high resistance circuits to within 0·1 mv. and currents $\nless 10^{-16}$ amp. can be measured. It is suitable for measuring insulating resistance, photo-electric, condenser leakage, and diffusion currents, and corrosion and oxidation–reduction potentials. C. R. H.

Amperometric titrations. I. M. KOLTHOFF (Trans. Electrochem. Soc., 1940, **78**, Preprint **22**, 311—326).—The end-point of a titration is determined by measuring the current passing through the solution between the indicator electrode and an appropriate depolarised reference electrode. Examples of titrations using a dropping Hg electrode as indicator electrode are given. The method, which is rapid, gives high accuracy with dil. solutions and is especially applicable to pptn. titrations where the ppt. is relatively sol. Conditions under which non-reacting substances substantially contribute to the current should be avoided. C. R. H.

Electron-ray titrimeter. E. J. SERFASS (Ind. Eng. Chem. [Anal.], 1940, **12**, 536—539).—Two thermionic voltmeters that operate from a.c. or d.c. lighting circuits are described. The voltmeters are suitable for potentiometric titrations. The unrectified circuit described is suitable for use with polarised electrodes, and the rectified circuit can be used for titration systems requiring the use of a calomel cell. L. S. T.

Screened mercury-electrode clamps for dielectric measurements. E. RUSHTON and E. J. PRATT (J. Sci. Instr., 1940, **17**, 247—248).—Hg-electrode clamps with guard ring are described for the accurate determination of ϵ and power factor of insulating materials in the form of discs $\sim$5 cm. in diameter. L. S. T.

Design and performance of an electron diffraction camera. J. E. RUEDY (Rev. Sci. Instr., 1940, **11**, 292—295).—The design of an electron diffraction camera for the investigation of photo- and secondary electron emission from surfaces is described. Electron beams with velocities up to 40 kv. can be obtained, and the max. beam current is 0·1 μa. New designs for adjustment of the specimen and for the photographic shutter control are incorporated. A. J. M.

Locknut for a weight burette. M. KILPATRICK (Ind. Eng. Chem. [Anal.], 1940, **12**, 548).—A device that holds the ground cup of a wt. burette in place during transfer to and from the balance is described and illustrated. L. S. T.

Apparatus for the determination of sulphur by the evolution method. R. S. GIBBS and F. B. CLARDY (Ind. Eng. Chem. [Anal.], 1940, **12**, 535).—An arrangement permitting 40—50 determinations to be made simultaneously is described. L. S. T.

Spiral screen packing for efficient laboratory fractionating columns. H. S. LECKY and R. H. EWELL (Ind. Eng. Chem. [Anal.], 1940, **12**, 544—547).—A continuous flat spiral of metal gauze enclosed between two concentric glass tubes forms the basis of the fractionating columns described. Their construction and performance are also described. L. S. T.

Saybolt one fifteen viscosimeter. E. W. DEAN, E. L. RUH, and R. W. WALKER (Ind. Eng. Chem. [Anal.], 1940, **12**, 540—542).—This instrument is

identical with the universal model except that the diameter of the outflow tube is smaller. Data for calibration, and the method of operation, are described. L. S. T.

Comparative study of water aspirators. E. P. LITTLE and S. E. POND (Rev. Sci. Instr., 1940, **11**, 285—286).—Fourteen aspirators have been compared as regards relative speed of evacuation, H_2O consumption, air-pumping ability, and final vac. produced. A. J. M.

Portable aspirator pump. R. C. HOCKETT (Ind. Eng. Chem. [Anal.], 1940, **12**, 539—540).—A pump for removing large vols. of solvent from non-volatile materials is described. L. S. T.

Versatile gas saturator. W. R. RINELLI and K. S. WILLSON (Ind. Eng. Chem. [Anal.], 1940, **12**, 549—550). L. S. T.

Use of wetting agents in glass apparatus. W. H. WHITE (Ind. Eng. Chem. [Anal.], 1940, **12**, 550).—Addition of 0·5% of Tergitol 4 ensures uniform flow of a liquid down a greasy glass surface, and practically eliminates the necessity of cleaning. The addition is particularly useful in gas analysis apparatus and in H_2O gauges. L. S. T.

Flat-bottomed micro-cups as weighing bottles and reaction vessels for Kjeldabl analyses of viscous liquids. G. E. FERGUSON and L. SCHEFLAN (Ind. Eng. Chem. [Anal.], 1940, **12**, 553).—The viscous liquid is weighed in a cup of 1 ml. capacity cut from flat-bottomed 10-ml. specimen tubes. The cup and sample are placed in a Kjeldahl flask for the usual digestion. L. S. T.

Preparing asbestos for filtering mats. B. L. KASPIN (Ind. Eng. Chem. [Anal.], 1940, **12**, 517).—Apparatus for shredding asbestos mechanically is described. L. S. T.

Desiccators for analytical work and sodium carbonate as a titration standard. L. RAMBERG (Svensk Kem. Tidskr., 1940, **52**, 137—143).—Weighable amounts of H_2O are taken up during the cooling of ignited material in an ordinary desiccator owing to replacement of dry air by moist when the material is inserted and poor air circulation inside the desiccator when closed. A desiccator through which flows a continuous dry air stream is described; the free space is reduced to a min. and a series is necessary for vessels of different sizes. With this apparatus freshly made Na_2CO_3 (from $NaHCO_3$ at 290° for 30 min.) may be used as a titration standard with an error of $<0·02\%$. M. H. M. A.

Geochemistry.

Fluorine content of Chengtu well water. L. T. CHENG and T. P. CHOU (J. Chinese Chem. Soc., 1939, **7**, 36—39).—The F content of H_2O from different wells varies from 0·095 to 3·6 p.p.m.; 19 wells gave F content <1 and $4 > 1$ p.p.m. The relation of [F] to the incidence of unsound teeth is not clear. A. T. P.

Limnological studies in Connecticut. V. Regional limnology. E. S. DEEVEY, jun. (Amer. J. Sci., 1940, **238**, 717—741).—Limnological data obtained from 49 lakes in Connecticut and New York indicate a close relationship between regional geology and quantity of phytoplankton. Within the Central Lowland, underlain by sol. sedimentary and igneous rocks rich in Fe, occur lakes rich in P and phytoplankton, whilst lakes surrounded by the metamorphic rocks of the Eastern and Western Highlands are correspondingly poor. P appears to be the most important element controlling phytoplankton growth, but N (determined as winter NO_3') has a significant effect. The distribution of HCO_3' alkalinity is correlated closely with the occurrence of limestone formations, but, except in hard-H_2O lakes, HCO_3' alone probably has little significant effect on plankton production. Humus colour is probably more important than quantity of plankton in reducing the penetration of light into the lakes. Sol. and total P indicate that Connecticut resembles N.-E. Wisconsin and Japan in being oligotypic for P. L. S. T.

Tauq meteorite, Iraq. W. A. MACFADYEN and G. F. CLARINGBULL (Min. Mag., 1940, **25**, 615—620).—Details of the fall of this meteorite in 1929 are not available. It is a white chondrite with Mg : Fe about 5 : 1, and about 3% Ni–Fe. L. J. S.

Fifteenth list of new mineral names. L. J. SPENCER (Min. Mag., 1940, **25**, 621—660).—A dictionary list of 225 new names collected from the 1938—40 literature, giving bibliographical references, chemical formulæ, etc. A systematic chemical classification is appended. An index of authors covers the period 1926—40 (lists 11—15). L. J. S.

Selenium ore deposit at Pacajake, Bolivia. H. BLOCK and F. AHLFELD (Z. pr. Geol., 1937, **45**, 9—14; Chem. Zentr., 1937, i, 4081).—The ore, which occurs in pockets near Pb–Ag mines, consists chiefly of blockite, $(Ni,Cu)Se_2$, with clausthalite and naumannite. The concentrates contain $\not> 0·05\%$ of Pt metals, probably as Pd selenite. Native Se is also plentiful. Chalkomenite, $CuO,SeO_2,2H_2O$, cobaltomenite, and probably molybdomenite and Ni selenite occur as crusts of a few small crystals on limonite deposits. A. J. E. W.

Occurrences of pyrophyllite in the Alps. H. MEIXNER (Zentr. Min., 1937, **A**, 117—120; Chem. Zentr., 1937, i, 4351).—Five occurrences of pyrophyllite (I) in the Alps, and their paragenesis, are discussed. The conclusions of Noll (A., 1937, I, 51) are confirmed in that (I) only occurs in presence of quartz. A. J. E. W.

Veins of gold ore in the Rehoboth district, South-west Africa. EDLINGER (Z. pr. Geol., 1937, **45**, 35—44; Chem. Zentr., 1937, ii, 30).—The deposits include Au-bearing pegmatites, which pre-

dominate, together with pyritic and cupriferous types of ore. A. J. E. W.

Secondary changes in gold in the Danubian deposits of the Hungarian Kisalföld. E. von Szádeczky-Kardoss (Mitt. berg-hüttenmänn. Abt. Palatin-Joseph-Univ. Sopron, 1936, **8**, 285—300; Chem. Zentr., 1937, i, 4081).—The Au grain-size is discussed in relation to the direction of the current and the geological age of the deposits. The Au occurs inside curves of existing and extinct branches of the Danube, partly with Ag in Fe pyrites; the placer Au is 95% pure and almost Ag-free. A. J. E. W.

Bertrandite and beryl from South Crofty mine, Cornwall. J. Phemister (Min. Mag., 1940, **25**, 573—578).—A stanniferous veinstone in granite contains microscopic crystals of bertrandite and beryl together with chlorite and tourmaline. Bertrandite and chlorite form pseudomorphs after beryl, and beryl also occurs as a second generation. L. J. S.

Jamesonite from Cornwall and Bolivia. L. G. Berry (Min. Mag., 1940, **25**, 597—608).—*X*-Ray photographs give a monoclinic unit cell, a 15·68, b 19·01, c (needle axis) 4·03 A., β 88° 12′; space-group $C_{2h}^5 = P2_1/a$. A discussion of published analyses and the highest determined d (5·63) indicate two mols. of $4PbS,FeS,3Sb_2S_3$ in this cell. Jamesonite is distinguished from boulangerite by its good basal cleavage and the presence of Fe. L. J. S.

Colloidal gold as a colouring principle in minerals. J. N. Friend and J. P. Allchin (Min. Mag., 1940, **25**, 584—596; cf. A., 1940, I, 47, 238).—A discussion of the coloration of minerals. Traces of Au were found in a large no. of minerals examined, and it is suggested that the blue colour of celestine and rock-salt is due to the presence of colloidal Au. Details are given of the method of analysis for traces of Au, Ti, Fe, Mn, etc. L. J. S.

Barite deposits of Northern Nevada. V. P. Gianella (Amer. Inst. Min. Met. Eng., Tech. Publ. 1200, 1940, 6 pp.; Min. Tech., **4**, No. 4).—The mineral occurs fairly widely distributed in veins and as replacement deposits in limestone, apparently having been deposited from rising hot waters probably contemporaneous with those responsible for some of the metallic ores of the state. The more important deposits are described in detail; the present annual output is ~15,000 tons. A. R. P.

Alteration of tremolite and talc in the dolomite marbles of Yellandu Warangal District (Hyderabad, DN.). N. Jayaraman (Proc. Indian Acad. Sci., 1940, **12, A**, 65—72).—Six specimens of tremolite in various stages of transformation into talc have been examined. In the alteration almost all the Ca is lost, Al_2O_3 and H_2O of constitution accumulate, and Fe^{II} is oxidised. W. R. A.

Pisolitic laterite in the chalk region of Železnik. F. Kratochvil (Věstn. Československ. Akad. Zeměd., 1936, **12**, 165—176; Chem. Zentr., 1937, i, 4918).—Pisolitic kaolin inclusions are found in a deposit near Gitschin, which contains kaolinite, limonite, and small amounts of goethite and magnetite. The largest pisolites (d 2·842—2·639) are 5·8 mm. in diameter; they usually lose H_2O at 300—420°. The genesis of the deposit is discussed. A. J. E. W.

Apatite crystals from Kimoto. G. Pehrman (Geol. Fören. Stockholm Förh., 1937, **59**, 109—111; Chem. Zentr., 1937, ii, 30).—A green apatite (c 0·7335) which occurs with quartz in miarolitic cavities in pegmatite, and an older black variety (d 3·258), are described. A. J. E. W.

Archean mylonite from N.-W. Ontario. J. D. Bateman (Amer. J. Sci., 1940, **238**, 742—750).—A mylonitised granitic intrusive is described. Chemical analyses [W. F. Green] of the fresh granite porphyry and its mylonitic equiv. show that, except for a loss of SiO_2, mylonitisation has taken place without marked change in the bulk chemical composition. L. S. T.

Water of constitution of certain typical soils of the Central Provinces, and its bearing on the parent rock material from which the soils are formed. R. H. Joshi and K. G. Joshi (Nagpur Univ. J., 1939, 89—93).—Data given for various soils show that no constitutional H_2O is lost up to 125°, and that ~33% is lost between 125° and 180°. Complete removal is effected only by ignition. H_2O of constitution of the soils is not affected by variations in the clay content. It is first formed during initial hydration of rock minerals, and is increased subsequently as weathering progresses to form clay. Soils derived from trap rock show the highest H_2O of constitution (5—6%), and those from sandstone the lowest (~1%). L. S. T.

Mechanism of formation of periodic layers of ice on freezing of soil. F. M. Schemjakin and P. F. Michalev (Kolloid. Shurn., 1938, **4**, 369—372).—From the analogy between the differential equations of diffusion and thermal conductivity an equation for the distance between the layers, which agrees with Taber's results (J. Geol., 1929, **37**, 428), has been deduced. R. C.

Soil clay mineralogy of some Australian soils developed on granitic and basaltic parent material. J. S. Hosking (J. Counc. Sci. Ind. Res. Australia, 1940, **13**, 206—216).—The separation of the colloidal clay fractions from 19 samples of soil and their examination by *X*-ray diffraction are described. The granite soils are characterised by kaolinitic types irrespective of the conditions under which they were formed, but with the basaltic soils the type present depends on the soil moisture conditions; the red loams contain only kaolinitic types, whilst montmorillonitic types with a little kaolinitic are present in the red-brown earths, and montmorillonite alone is typical of the black earths. Where climatic conditions lead normally to development of the kaolinitic type, restriction of free drainage produces montmorillonitic clay in soils formed over certain basic rocks. Accessory quartz, hydrargillite, and goethite and/or hæmatite are also present in certain soils. J. N. A.